Environment Canada
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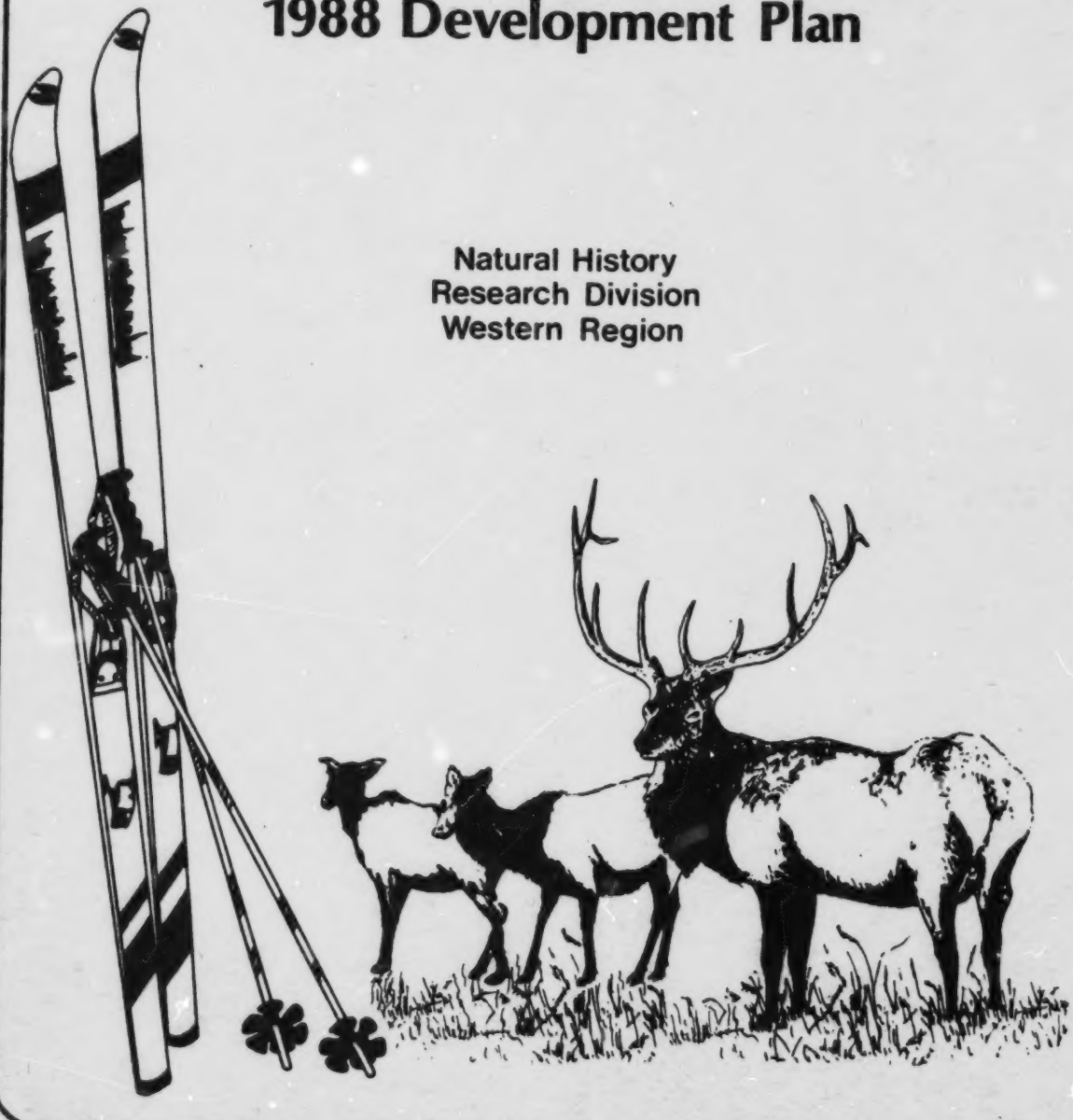
Final Report

Initial Environmental Evaluation for the

Mount Norquay Ski Area

1988 Development Plan

Natural History
Research Division
Western Region



Canada

1989

FINAL REPORT

INITIAL ENVIRONMENTAL EVALUATION

FOR

THE MOUNT NORQUAY SKI AREA 1988 DEVELOPMENT PLAN

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CALGARY, ALBERTA

CANADIAN PARKS SERVICE

1989

EXECUTIVE SUMMARY

The operator of the Mount Norquay Ski Area in Banff National Park, Banff Lifts Limited, has submitted a "Plan for the Improvement and Expansion of Mt. Norquay Ski Area" (Banff Lifts Limited, 1988) to the Canadian Parks Service.

The development plan contains three major proposals :

- redevelopment and upgrading of facilities within the existing ski area, including relocation of the base lodge;
- closure of underused trails on the south-facing slopes of Mount Norquay;
- ski terrain preparation on Skyline Ridge and Bruno avalanche gully, and construction of lift(s) to service the new area.

At the conceptual level of detail available, redevelopment and upgrading proposed within the existing area appear to be environmentally acceptable, provided that they are accomplished in an environmentally sympathetic fashion and conform to ski area operational guidelines currently being prepared for use at ski areas in Banff and Jasper national parks.

Abandonment of the North American run and reforestation of overly wide cleared areas will be significant positive achievements in the protection of highly important wildlife habitat and improvement to aesthetic values.

Ski terrain development on Skyline Ridge will have an environmental cost due to terrain recontouring to smooth rough topography in the Bruno avalanche gully and to construct traverses for skiers. Loss of productive and important wildlife habitat will also result from clearing of avalanche shrub meadows. The severity of these impacts cannot be determined until greater detail about development proposals are available. The proposed high level traverse would be unacceptable due to public safety concerns, high visual impact, and dismal rehabilitation prospects.

The effect of water withdrawal for snowmaking purposes to Forty Mile Creek is unknown. Further investigation is required to assess the extent and significance of impacts to aquatic habitats, and methods which would limit these impacts to an acceptable level.

The existing cross-country ski trail at the base of the Skyline Ridge will be upgraded and used as a traverse for downhill skiers. To prevent the public safety hazard and user conflicts which would result if downhill skiers and cross-country skiers shared the traverse, the cross-country trail must be relocated.

The conceptual level of detail provided in Banff Lifts Limited's development plan does not permit a definitive evaluation of the severity of environmental impacts. However, based on an examination of the Skyline Ridge area and the conceptual proposals presented in the 1988 Mount Norquay Development Plan, it appears that development of the Skyline Ridge area could be accomplished in an environmentally acceptable fashion.

Therefore, based on environmental issues, the Mount Norquay development plan is conceptually acceptable. Development on Skyline Ridge must not proceed until a plan which specifically addresses all aspects of facility construction, ski run preparation, terrain recontouring, vegetation removal, public safety, ski area operations, and socio-economic impacts has been prepared and examined at a more detailed level for environmental and public safety concerns.

"The Parks are hereby dedicated to the people of Canada for their benefit, education and enjoyment, subject to the provisions of this Act and the regulations, and such Parks shall be maintained and made use of so as to leave them unimpaired for the enjoyment of future generations".

Section 4; National Parks Act

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PART 1

INTRODUCTION

1.1 BACKGROUND

During the 1970's, the Canadian Parks Service (Parks) established a program to produce long range development plans for each of the four ski areas in Banff and Jasper national parks. Parks' policy (Canadian Parks Service, 1979) states that although no new ski areas were to be established in Canada's national parks, existing ski areas would be permitted to develop to the capacity of their legislated boundaries. Environmental protection is the priority consideration.

In co-operation with each of the ski area owners, Parks has participated in the preparation and implementation of long range development plans for the ski areas. Public consultation programs have informed interested citizens of the findings and possibilities, and solicited their comments and opinions. At the conclusion of this planning program, a plan for Mount Norquay will be approved by the Minister of the Environment. The ski area boundary will be included in the National Parks Act formalized through an Order-in-Council.

1.2 THIS STUDY

In June 1982, Banff Lifts Limited submitted a development plan for the Mount Norquay Ski Area to the Canadian Parks Service. They subsequently have revised this plan four times, with the most recent revision submitted to Parks in September 1988. This Initial Environmental Evaluation (IEE) is a preliminary examination of the environmental considerations inherent in ski hill redevelopment and possible expansion. It has been prepared in compliance with the intent and purpose of the federal Environmental Assessment and Review Process (EARP), and is consistent with Parks policy direction (Canadian Parks Service, 1979) on the application of EARP. An earlier draft (October 1988) was offerred for public comment, and also reviewed by Environment Canada's Regional Screening and Co-ordinating Committee. This document incorporates comments provided on that draft.

PART 2

THE PROJECT SETTING

2.1 LOCATION

The Mount Norquay Ski Area is located in Banff National Park, about 130 km west of Calgary, Alberta (Figure 1). Banff town is very close to the ski area, with the existing day use facilities 8 km from the townsite -- about a 10 minute drive.

The existing ski hill development is situated primarily on the east slopes of Mount Norquay and a west slope of Stoney Squaw Mountain. Forty Mile Creek flows below the north slopes of Mount Norquay, curving around the east slope of Stoney Squaw Mountain. It joins with the Bow River 2 km downstream near Banff town. The Bow River Valley defines the south edge of both mountains (Figure 2).

If developed according to the Mount Norquay long range plan proposal (Banff Lifts Limited, 1988), ski terrain and new facilities would be developed on Skyline Ridge, some redevelopment would occur within the existing ski area, and ski terrain on the south-facing slope of Mount Norquay would be retired.

2.2 DECLARATION

In the long range plan, Banff Lifts Limited (BLL) (the "proponent") proposes to reconstruct existing lifts, build a new day lodge, develop new lifts and ski terrain on Skyline Ridge, expand artificial snowmaking and abandon an existing ski run at the Mount Norquay Ski Area. BLL owns the equipment, structures and facilities, and occupies the Crown's land on the basis of a License of Occupation. Upon approval of a ski area plan, a long term lease will be executed.

Based on BLL's proposal, input from Parks and a public participation program, a development plan will be approved. That approved plan will describe the amount, location and kind of additional facilities, structures and activities which will be permitted. It will identify the boundary for maximum areal extent of land to be held under lease and considered for potential ski area use or development. Special procedures to protect natural and cultural resources, visitor use and appreciation of those resources, and public safety are important considerations.

Figure 1: Mount Norquay Ski Area — Regional Setting

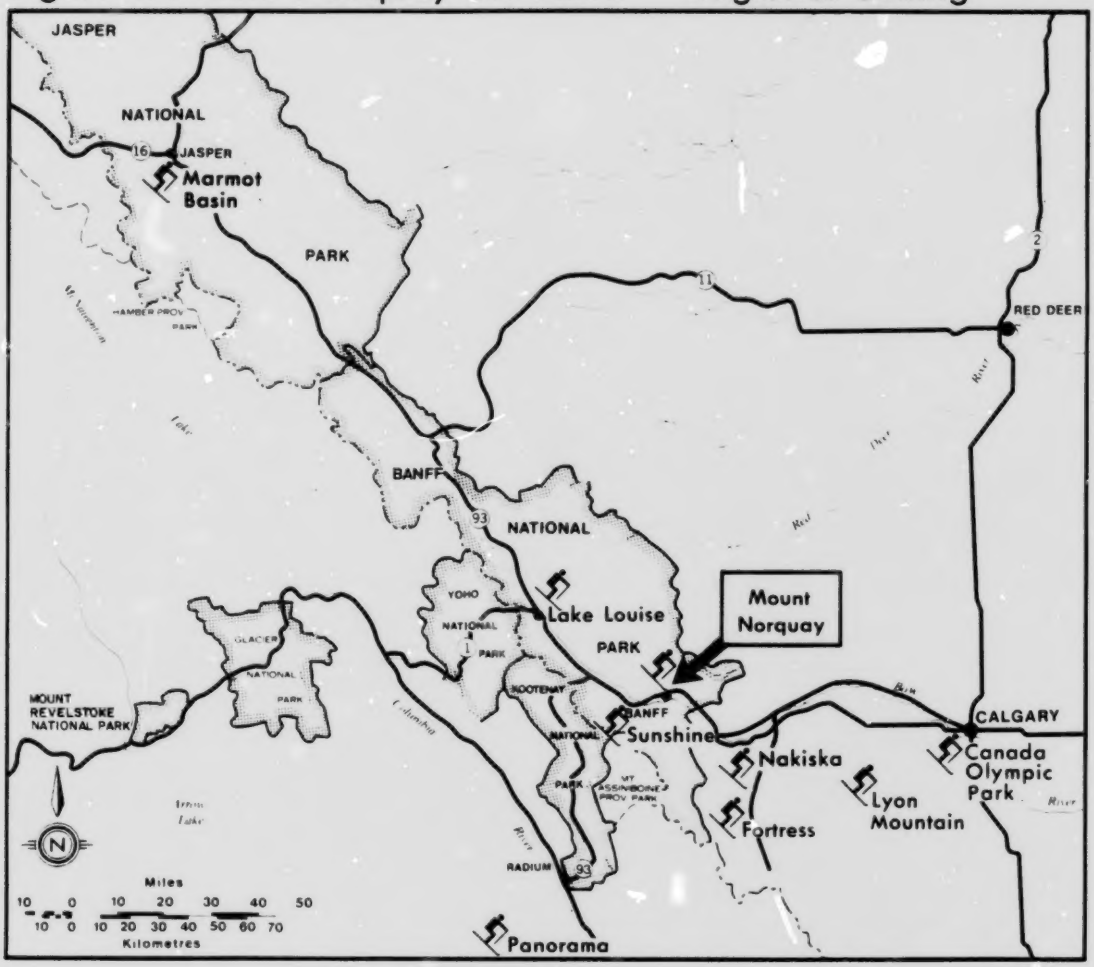

Figure 2: Mount Norquay Ski Area — General Topography

BLL has submitted a number of draft development proposals and Parks staff have reviewed each one to identify potential environmental impacts. BLL has responded to Canadian Parks Service concerns by revising the development proposals to avoid or minimize major environmental impacts associated with plan components. This IEE reviews the environmental effects of the various development scenarios and focuses on those proposals which are incorporated in the current development plan.

The development proposal provided by the proponent is conceptual in nature and as a result this environmental impact assessment has been able to foretell and predict only obvious potential environmental effects. Recommendations for procedures to mitigate the environmental impacts are similarly non-specific. More environmental investigation, identification of resource impacts and mitigating measures will be required on a site-specific basis before implementing this development plan.

This IEE does not propose a plan for ski area development, nor is it an analysis of the economic viability or the appropriateness and desirability of the terrain to attract skiers. However, where these issues may relate to environmental factors they are briefly addressed.

Canadian Parks Service officers have prepared this document, and Parks is responsible for the data, analysis and interpretations. The information has been collected by field surveys, on-going research programs, reference to existing reports, and personal consultation with knowledgeable individuals. The development proposal was supplied by Banff Lifts Limited.

2.3 LEGISLATIVE AND POLICY DIRECTION

2.3.1 The National Parks Act

Legislation which guides the creation and management of National Parks in Canada is provided in the National Parks Act which was first passed in 1930. Although revisions to the Act (Bill C-30) were passed by the House of Commons on July 18, 1988, the dedication clause remains as before:

> The Parks are hereby dedicated to the people of Canada for their benefit, education and enjoyment, subject to the provisions of this Act and the Regulations, and such Parks shall be maintained and made use of so as to leave them unimpaired for the enjoyment of future generations. (National Parks Act, Section 4)

The National Parks Act limits the number of commercial ski areas in national parks to those already established. It provides for the legislation of boundaries of those ski areas:

> The Governor in Council may, by an order amending Schedule III, designate a portion of Banff National Park in the vicinity of Mount Norquay and in the vicinity of Sunshine Village Ski Area a commercial ski area, but that schedule is not subject to subsequent amendment by the Governor in Council.

2.3.2 National Parks Policy

Guidance in the management of national park lands and activities is provided by a series of policies and directives. These instructions to park managers have been developed to aid in the implementation of the National Parks Act, and to ensure a consistent and reasonable approach to the accommodation of the use and protection of the parks' resources.

Following nearly 100 years of management and a nation-wide public consultation program, Parks' 1979 Policy reaffirmed that the prime objective of national parks is to protect and present heritage natural resources for the understanding and enjoyment of existing and future generations. The Policy (Canadian Parks Service, 1979) explains that :

> Parks Canada will make protection of heritage resources its primary consideration.
>
> Ecological and historical integrity are Parks Canada's first considerations and must be regarded as prerequisites to use. Protection of heritage resources is fundamental to their use and enjoyment by present and future generations.

The National Parks Policy makes specific reference to recreational use of parks :

> Parks Canada will provide for a variety of outdoor recreation opportunities which are a means for Park visitors to enjoy and understand the Park's natural environment and which are consistent with the protection of Park resources.
>
> Parks Canada will provide for those outdoor recreation activities which are dependent upon a Park's natural resources and require a minimum of man-made facilities.

> Within the above constraints, provision will be made for activities in which visitors of diverse interests, ages and skills can participate throughout the year . . .
>
> Parks Canada will regulate the amount, kind, time and location of outdoor recreation activities using the Zoning Plan and other management actions to protect Park resources or to ensure visitor safety and enjoyment.

A particular guide for downhill ski facilities directs that :

> No new golf course and downhill ski areas will be developed in National Parks. Where downhill ski areas exist they will be permitted to develop to the capacity of their legislated boundaries.

2.3.3 Management Framework for Four Mountain Parks

In Trust for Tomorrow, A Management Framework for Four Mountain Parks (Canadian Parks Service, 1986) defines the overall context which guides the protection, management, development and future planning of Banff, Jasper, Kootenay and Yoho national parks for the next 15 years. The Management Framework does not provide specific direction for ski area development plans as they continue to be addressed through separate programs. Nevertheless, some of the Block Direction Statements are highly relevant.

The following Block Direction Statements occur in the section dealing with protecting and managing resources in the four national parks :

> The Direction Statements for Resource Protection and Management take precedence over implementation of Direction Statements for Visitor Understanding, Appreciation and Enjoyment . . . because the need to protect resources limits the amount, type and level of acceptable use in the four mountain Parks.
>
> The management of facilities and visitors cannot be isolated from protection of the Parks' resources, and such management must safeguard plant and animal habit ts, as well as the physical surroundings and aesthetics of the Parks.
>
> Parks facilities and activities will operate in the context of continuously and rigorously protecting the Parks' aquatic resources.

Any necessary modification of stream channels or flows will be made in ways that minimize water siltation, loss of habitat, and changes to natural flow patterns.

Because of the importance of the montane ecoregion for both resource protection and visitor use, special measures will be developed to minimize the harmful consequences of current or past uses.

No activity that might harm vegetation can be approved before rehabilitation plans have been made.

Areas that contain important wildlife habitats will be carefully protected. The criteria to be applied when identifying habitats as important will include the following facts :. . .

that the area is a vitally important seasonal habitat for wildlife.

The aesthetic quality of the Parks will be given highest priority in all future activities and the impact of daily operations on the aesthetics of the parks must be minimized.

Block Direction Statements dealing with visitor understanding, appreciation, and enjoyment also have a direct bearing on the Mount Norquay Ski Area planning program. Background to the Direction Statement explains :

Fortunately, the tourism industry itself recognizes that its own long-term interests are damaged by unbridled exploitation of the parks for tourism purposes. Parks' assets - either natural or built - must be preserved for the use and enjoyment of future generations of Canadians, to whom the Parks belong, and of visitors, even if such preservation limits the number of people who can be accommodated.

A Block Direction Statement follows that explanation :

The primary role of the Four Mountain Parks in the Rocky Mountain region is to protect heritage resources and to retain and preserve existing wilderness.

In specific reference to downhill ski areas, the Management Framework says :

> Efforts to legislate boundaries for each downhill ski area will continue. Parks Canada will also continue to co-operate with ski area and golf course operators to ensure that natural resources are impaired as little as possible and that visitors' experiences are enhanced.

2.3.4 Banff National Park Management Plan

Following the 1986 ministerial approval of the Management Framework, a park management plan has been prepared for Banff National Park. The Mount Norquay Ski Area is designated as a Zone IV area, where outdoor recreation opportunities and related facilities can be accommodated in ways that respect the natural landscape and that are safe and convenient (Canadian Parks Service, 1979; 1988).

2.3.5 Western Region's Downhill Skiing Policy

Alberta's national parks contain four downhill ski areas : Lake Louise, Mount Norquay and Sunshine in Banff National Park, and Marmot Basin in Jasper National Park. Parks' Western Region's approach (Canadian Parks Service, 1976) to implementing Parks' policy is :

> Each area will be planned and allowed to develop to a scale that optimizes the recreational skiing potential in harmony with the environment.

Criteria considered in preparing the long range plans include:

> . . . the skiers, as National Park visitors, should be provided the opportunity for a high quality experience. This suggests a variety of terrain to cater to beginners, experts, and the range of skills in between. Waiting time required to use lift lines should ideally be short, the access system should function smoothly and efficiently, and the lodges should provide adequate food and sanitary facilities.
>
> . . . in concert with facility development there must be recognition of the national park setting and the need for the highest standards of environmental awareness and management. When there is doubt as to development for skiing or preservation of important features of the national parks, the decision must favor the national park values.

2.3.6 Criteria for Ski Area Boundaries

Recommendations in this IEE are based on environmental factors. Other considerations will also be used to define the ski area boundary, including the following criteria which have been used to assist in determining the boundaries for the Sunshine, Lake Louise and Marmot Basin ski areas :

(1) Slopes which are reasonably accessible from existing or planned lifts and which are complementary to the lift system are to be enclosed within the boundaries.

(2) Access roads which are public highways under the jurisdiction of Parks shall be outside the ski area boundaries.

(3) Parking areas for ski area patrons are the responsibility of the ski area and shall be enclosed within the boundaries.

(4) Avalanches which need to be controlled for the safety of patrons of the ski area shall have their paths from trigger zone to runout enclosed within the ski area boundaries.

(5) Boundaries should be logical, make administrative sense, and be reasonable for survey purposes.

2.4 MOUNT NORQUAY SKI AREA : AN HISTORICAL PERSPECTIVE

The history of skiing in Banff National Park is intimately entwined with the development of the Mount Norquay Ski Area.

The first event was the arrival of a pair of skis in Banff, sent from Montana to George Paris shortly before 1900. By 1917, the year of the first Banff Winter Carnival, there was enough interest to have ski jumping as an event (Lothian, 1968).

In 1920, a Class A ski jump was erected on the slopes of Tunnel Mountain near the Indian Grounds. As cars became more common in Banff, automobile traffic interfered with the use of this jump and the slopes of Mount Norquay became the area's centre for ski jumping and downhill skiing. In 1927, the Mount Norquay Ski Club was organized and the following year, a clubhouse was built at the foot of Mount Norquay (Lothian, 1968). This served as a focal point for skiing in Banff, and in 1930 the first official slalom race was staged on a run described as "a long, open and exceedingly tricky 300 feet" (White in Lund, 1977).

During the 1930's Depression, an Unemployment Relief Program was introduced to provide employment, particularly for local residents. A new road up Stoney Squaw Mountain was proposed as a likely project, expected to cost $31,000 and require 225 man-months of labor. Accordingly, right-of-way clearing began in December 1931, and by 1937 the road was completed. It provided easier access to the ski slopes of Mount Norquay and no doubt strengthened the establishment of skiing in the park, with skiers from the surrounding area and Calgary becoming regular visitors to the Mount Norquay facilities (Potyondi, 1984). A major reconstruction of the road was carried out during the 1950's.

In 1936, ski jumping was encouraged by the erection of a ski jump at Mount Norquay by Park authorities. The original jump was damaged by excessive snowfall, so in the 1950's the National Park Service built a ski jump and judges' stand adequate to meet standards of the International Ski Federation (Lothian, 1968).

In 1937, the original clubhouse was lost to fire. Nevertheless, the Dominion Ladies Ski Championships were held at Mount Norquay in 1938. In 1939 the new ski lodge was built by the Canadian Rockies Winter Sports Limited, in time for the Dominion Ski Championships held in 1940 (Lothian, 1968). With hindsight, the competitors at these events must have felt aggrieved because in 1941 a ski-tow was installed to make the uphill trip easier for the downhill skier (Harmon, n/d).

In 1947, two events of significance to Mount Norquay occurred. A second tow was installed and George Encil approached the Park's Department to build a chairlift which could be used year-round. In 1948, Encil's "Banff Chairlift Corporation" built the original Norquay chairlift. Being the first chairlift in the Rockies, it was a major visitor attraction, carrying 59 chairs for 975 m (with a rise of 400 m) in 7 minutes. It operated at a loss during the winter, but profitted during the summer (Lothian, 1968), with about 85% of its gross revenue obtained through summer operations (Arnold, Crawford and Prothroe, 1956). Competition increased, and by 1954 ski areas at Sunshine (also owned by Mr. Encil) (Arnold, Crawford and Prothroe, 1956) and at Lake Louise had comparable equipment.

The Banff Chairlift Corporation (George Encil) continued to upgrade the facilities. In 1951, an additional tow was installed and the ski lodge was remodeled (Lothian, 1968).

In 1959, both the upper terminal tea room (Cliffhouse) and the rebuilding of the access road were completed. Economically, these accomplishments were somewhat offset when, despite Encil's protests to Park authorities (Arnold, Crawford and Prothroe, 1956), a new sightseeing lift began operation on Sulphur Mountain. By 1960 the Mount Norquay Ski Area had a new owner - Walter Fisher (Lothian, 1968).

The 1960's were a busy decade at Mount Norquay. In 1961, the two rope tows were replaced by poma lifts. In 1962, the single-seat chairlift was upgraded by the installation of double chairs and the lower terminal was reconstructed to accommodate the expanded services. In 1964, the Wishbone slope to the north of the existing area was cleared to provide better novice and intermediate skier terrain (a shortage that still exists today). A T-bar provided uphill transportation for the new run. In 1966, gondolas replaced chairs for the summertime operation of the Mount Norquay chairlift (Lothian, 1968).

Meanwhile, the National Parks Service was co-operating with the Calgary Olympic Development Association in an attempt to attract the Winter Olympics to Banff ski areas. Applications to host both the 1968 and the 1972 Winter Olympic Games were unsuccessful (Lothian, 1968). However, Mount Norquay has been the site of a number of international events. In 1972, grand slalom and slalom events were held. Freestyle competitions occurred in 1981 and 1982, Interski was held in early 1987, and the North American Snoboarding Championships took place in spring 1988. National competitions recently held at Mount Norquay are Nordic combined (Canadian championship) in 1983 and the Nor-Am giant slalom and slalom in 1985. Mount Norquay has Federation Internationale de Ski (F.I.S.) homologated giant slalom and slalom (2 slopes) approved runs (Bronson and Moriyama, 1985).

The Mount Norquay Ski Area still lacked sufficient terrain attractive to novice and intermediate skiers. In an attempt to improve the situation, a T-bar was installed on Stoney Squaw Mountain in 1969 (Banff Lifts Limited, 1983).

In 1972, the operation was acquired by Banff Cablelifts Limited. Six years later, in 1978, Mount Norquay ownership changed once again, with Sulphur Mountain Gondola Lifts Limited (now Banff Lifts Limited) taking control. Important improvements since 1978 include the installation of an airless snowmaking system for high skier traffic areas, the installation of a low water use vacuum toilet and wastewater system, renovations to the Cliffhouse and base lodge, reclamation of previously disturbed slopes, rebuilding and upgrading the catwalk access to runs off the Norquay chair, upgrading of existing lifts, new run clearing, and reconstruction of two ski jumps.

2.5 ALTERNATIVES

2.5.1 Abandonment

The alternative of removing the ski area facilities and restoring the area is not being considered at this time. Parks is currently committed to allowing Banff Lifts Limited to continue ski area operation until 2027 (a 42 year License of Occupation/lease from 1985).

2.5.2 Do-Nothing

The do-nothing development alternative preserves the status quo; Mount Norquay Ski Area would continue to serve only a limited segment of the skier market. Because of its proximity to Bow Valley residents, it would continue to function as a convenient "back-yard" ski area, and its challenging expert runs would continue to attract the skiing aficionado. Because the area lacks intermediate terrain it would be difficult to enlarge its market share.

2.5.3 Redevelop Existing Area

There is potential for some redevelopment within the existing leasehold boundaries. Reconfiguring some runs by reforesting broad cleared areas, increasing accessibility of the terrain by limited lift extension and upgrading base area facilities are options which could be considered without leasehold expansion.

2.5.4 Expand and Develop

The National Parks Act's direction with respect to ski areas is clear -- there will be no new ski areas; the existing ones will be permitted to expand to an optimal size defined by a legislated boundary and subject to protection of heritage resources. Ski areas will not be allowed to expand solely on the basis of demand without regard to protection of natural resources.

Given favorable economic conditions, Banff Lifts Limited proposes to expand the Mount Norquay Ski Area and upgrade and modify existing facilities. Parks is committed to optimal use of existing ski areas in order to limit environmental costs to those that have already been incurred. The development plan indicates that there is some opportunity to better use the Mount Norquay Ski Area and accommodate more skiers.

2.6 ASSOCIATED PROJECTS

Development of the Mount Norquay Ski Area affects, and is affected by, other projects in the surrounding region including other ski areas, the management objectives for Banff National Park, Banff town development, and national transportation facilities.

2.6.1 Other Ski Areas

Other ski areas in Banff National Park will continue to compete with Mount Norquay for clientele. In recent years, substantial upgrading of both Sunshine (gondola and more lifts) and Lake Louise (snowmaking and more lifts) has increased their attractiveness to the skiing public.

Expansion and redevelopment of the Mount Norquay area, especially snowmaking and the addition of more intermediate terrain, will help Mount Norquay compete more effectively in the general skier market, and may also strengthen the Banff-Lake Louise area as a skiing region.

A number of other downhill ski areas are readily accessible to Calgarians, Mount Norquay's major existing and potential market (Figure 1). Panorama, near Invermere, B.C. is a powerful competitor, with extensive snowmaking and on-hill accommodation. Fortress Mountain in Kananaskis Country also offers on-hill accommodation. Nakiska, also in Kananaskis, was developed by the Alberta Provincial Government for the 1988 Winter Olympics. Once Phase II is completed Nakiska will have a greater capacity than any other resort in Alberta, with a lift capacity of close to 10,000 skiers per day (D. Hayes, 1984). In addition, Calgary Olympic Park, a hillside ski area within the Calgary city limits, provides both competitive and training class ski jumps.

Other ski areas in western Canada and the northwestern United States compete for the ski package market. Marmot Basin in Jasper National Park; Todd Mountain, Silver Star, Big White, and Blackcomb-Whistler in British Columbia; Whitefish and Big Sky, Montana; Grant Targhee, Wyoming; Snow Mass, Vail, Aspen and Beaver Valley, Colorado; Alta, Utah; Squaw Valley, California; and Lake Tahoe, Nevada provide alternate destinations to skiers potentially interested in Mount Norquay.

At present the Mount Norquay Ski Area serves a special market. It is attractive to residents of the Bow Valley area because of its proximity to Banff townsite and Canmore. When snow conditions permit it also provides exceptional terrain for expert skiers. Expansion of the Mount Norquay area would broaden its appeal to a wider range of skiers.

In the short term, significant upgrading of existing areas and creation of new ski areas has increased competition for regional skiers. Mount Norquay's development plan attempts to improve the area's attractiveness to this market.

Over the long term, economic conditions and the demand for downhill ski facilities are difficult to predict. The success of Nakiska as a ski resort also has important implications. If it provides an attractive alternative for downhill skiers it may absorb much of the future demand that would otherwise be shared by other regional ski areas, including Mount Norquay.

2.6.2 Banff Town Development

The environmental implications of expanding Banff town have been assessed in "Banff Townsite Peripheral Land Use, Initial Environmental Evaluation" (Leeson and Harrison, 1988). Recommendations arising from that investigation contributed to a definition of development boundaries for the town and limitations to peripheral land use. Availability of increased staff housing, commercial accommodation, visitor amenities and support facilities (medical, sewer, water treatment, road maintenance, etc.) are limited by development opportunities in Banff townsite. Limited expansion of the Mount Norquay development is not expected to result in significantly increased demands for facilities and services in Banff.

2.6.3 Transportation Facilities

Recent upgrading of the Trans Canada Highway (TCH) through the lower Bow Valley in Banff has resulted in increased impacts to natural resources. The right-of-way has been enlarged, with attendant terrain and vegetation damage, and the highway has been fenced to prevent vehicle/wildlife collisions. This fence acts as a barrier to wildlife movement across the valley, despite the provision of underpasses. The TCH twinning is exemplary of the incremental impact to natural resources resulting from irresistible development pressures. Natural resources which remain intact become more valuable as they become more scarce. For example, the importance of the Mount Norquay area for sheep, deer, and elk habitat has been increased significantly because habitat and travel routes traditionally used by these species have been destroyed or otherwise been made unavailable by closeby development.

PART 3

THE PROPOSAL

3.1 PREVIOUS PROPOSALS

Since 1972, eight proposals have addressed development opportunities for the Mount Norquay Ski Area (Marshall Macklin Monaghan, 1972; Drapell, 1972; Everts, 1973; Underwood McLellan and Associates Limited, 1974; Banff Lifts Limited, 1982, 1983, 1986 and 1988). All of the plans recognized the lack of suitable terrain for intermediate skiing and suggested a number of ways to improve the situation, including expansion east onto Stoney Squaw Mountain (Banff Lifts Limited, 1982 and 1983), north onto Skyline Ridge (Underwood McLellan and Associates Limited, 1983; Banff Lifts Limited, 1988), further north onto the North Ridge (Banff Lifts Limited, 1982 and 1983), and south on Mount Norquay (Everts, 1973; Banff Lifts Limited, 1982, 1983 and 1986). Better grooming was suggested by all the plans, and the more recent plans (since 1982) have suggested artificial snowmaking as well. Upgrading within the confines of the existing ski area was proposed by all the development plans, and new lodge facilities have been an important component of all Banff Lifts' proposals. The Underwood McLellan concept (1983) included an off-season convention centre accommodating 400 guests.

3.2 THE PROPOSAL - GENERAL INTENT

The purpose of the proponent's proposal is to provide a basis for long term redevelopment and expansion of the Mount Norquay Ski Area. A boundary which delineates ski area limits will then be defined by legislation.

3.3 EXISTING FACILITIES AND USE

Annual skier attendance to the Mount Norquay Ski Area varies substantially with area visitation closely related to snowfall (Figure 3). (With the recent addition of a more extensive snowmaking system visitation may become more independent of natural snowfall.) Since 1966, skier visits have varied from 33,528 (1970) to 66,061 (1980), with an average attendance of 49,300 per season. During the same period (1966-1988), the season lasted from 111 to 171 days. Average season length was 137 days. Skiers to the Mount Norquay are primarily from Calgary and the Banff area. It is the most convenient ski facility for local residents of Banff, Canmore and the Bow Valley. Table 1 compares skier visits to Mount Norquay to total skier visits to Banff National Park.

Figure 3: Mount Norquay Ski Area —
Comparison of Skier Visits and Snowfall, 1969 — 1988

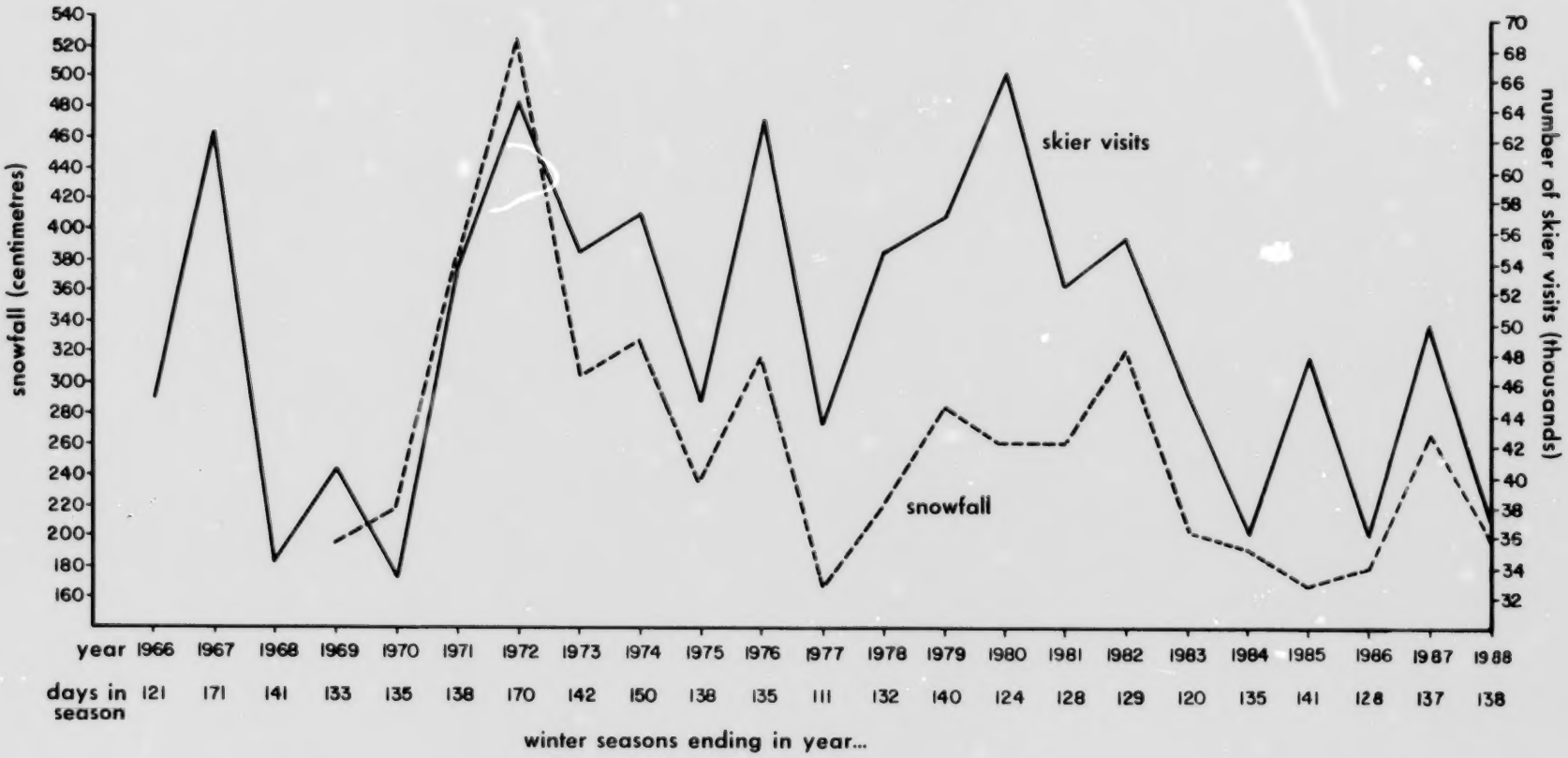

Table 1

Total Skier Visits
Banff National Park and Mount Norquay Market Share 1966-88

(Source : Banff Lifts Limited, 1986)

Season Ending In	Total Skier Visits To Mount Norquay	Total Skier Visits To Banff Park	Mount Norquay % Market
1966	45,190	160,159	28.2
1967	62,250	217,451	28.6
1968	34,230	201,890	16.9
1969	40,165	184,403	21.8
1970	33,528	214,268	15.6
1971	53,502	290,600	18.4
1972	64,305	371,061	17.3
1973	54,634	491,475	11.1
1974	57,117	411,296	13.9
1975	44,768	452,145	9.9
1976	63,456	550,011	11.5
1977	43,373	499,968	8.7
1978	54,514	577,468	9.4
1979	57,000	688,849	8.3
1980	66,061	702,355	9.4
1981	52,417	803,755	6.5
1982	55,644	910,000	6.1
1983	44,161	760,000	4.8
1984	36,990	680,000	5.3
1985	48,439	750,000	6.4
1986*	36,000	795,000	4.5
1987*	50,000	853,000	5.8
1988*	37,000	N/A	N/A

* A. Haenni, pers. comm. Banff Lifts Limited

Summer use has been an important activity at the area. About 20,000 people use the sightseeing gondola each summer (R.G. Fodor, pers. comm.).

Access to the ski area is provided by a paved, two-lane, 8 km road from Banff town. During the winter of 1981-82, traffic volume data was collected on the Mount Norquay Road (Brunell, 1982) indicating that the Winter Average Daily Traffic (W.A.D.T.) volume was 788 vehicles. (By comparison, the W.A.D.T. for the Sunshine Ski Area access road was 1,816 in 1981-82.) Figure 4 illustrates hourly flow patterns on the Mount Norquay road. Peak flows were experienced at the end of the skiing day, with arrivals to the hill usually spread throughout the morning. Figure 5 illustrates daily flow patterns throughout the winter of 1981-82. Weekend traffic is much higher than weekday (Monday-Friday) traffic.

There are four main parking lots which hold about 500 cars in total. There is also a limited amount of parking available adjacent to the base lodge, used by the ski area's management and staff.

The ski area can comfortably accommodate 1,000-1,100 skiers per day. There are five lifts with a total capacity of 4,200 skiers per hour (Table 2). A sixth lift, the Memorial rope tow, services a training hill for racers and is not used by the general skiing public. All lifts are electrically powered.

There are 19 ski trails covering about 37.2 hectares of skiable terrain at Mount Norquay* (Banff Lifts Limited, 1988) (Figure 6). This terrain provides some of the most exciting and difficult skiing available in Banff. Forty-five percent of the slopes are considered "expert". The Lone Pine, Memorial Bowl and North American runs are in this group.

Only 37% of the area is considered "intermediate". The Lone Pine lower slopes and runs off the Stoney Squaw and Wishbone T-bars are mostly at this level.

Eighteen percent of the terrain is suitable for beginners, who find attractive slopes off the Sundance Platter lift, the Wishbone T-bar and Stoney Squaw T-bar.

Mount Norquay currently provides night skiing on two main runs serviced by the Cascade chair and the Sundance tow.

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* Does not include the North American run below Prunepickers, or the lower Ski Out.

Figure 4: Two-way Hourly Traffic Patterns, Mount Norquay Ski Area Access Road, January 23–April 10, 1982
(Brunell, 1982)

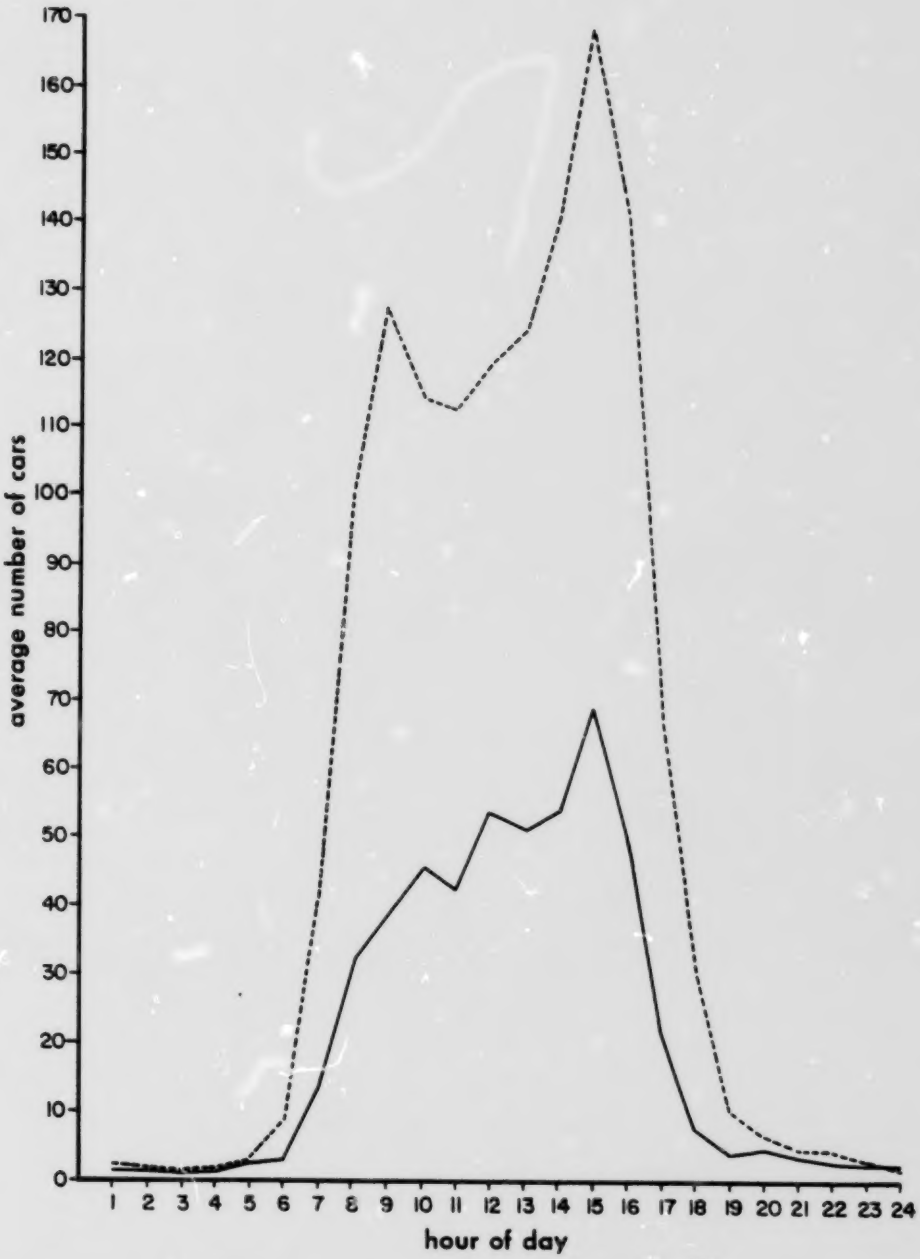


Figure 5: Daily Traffic Patterns, Mount Norquay Ski Area Access Road, January 23 — April 10, 1982 (Brunell, 1982)

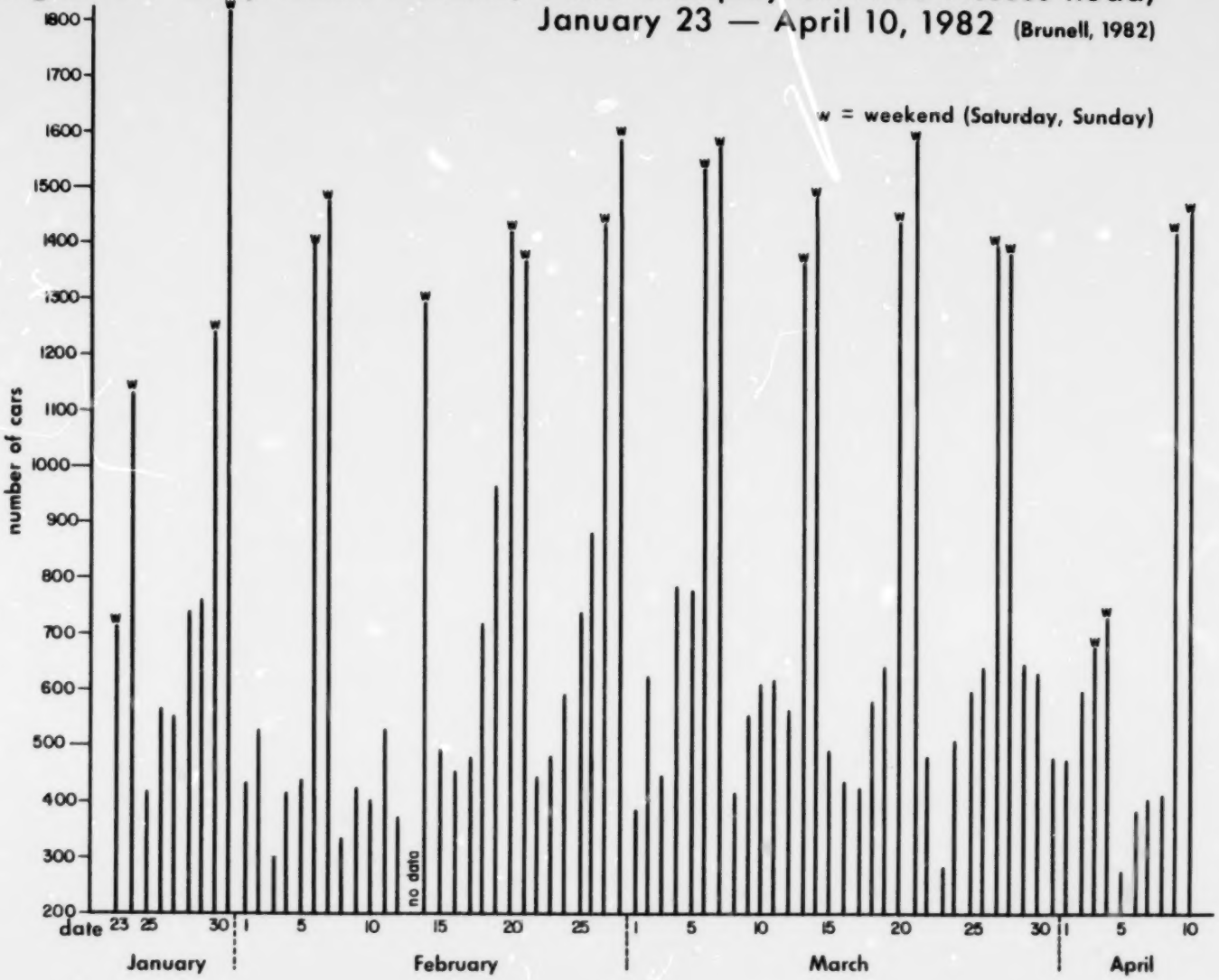


Table 2

Mount Norquay Lift Capacities (Banff Lifts Limited, 1983 and 1988)

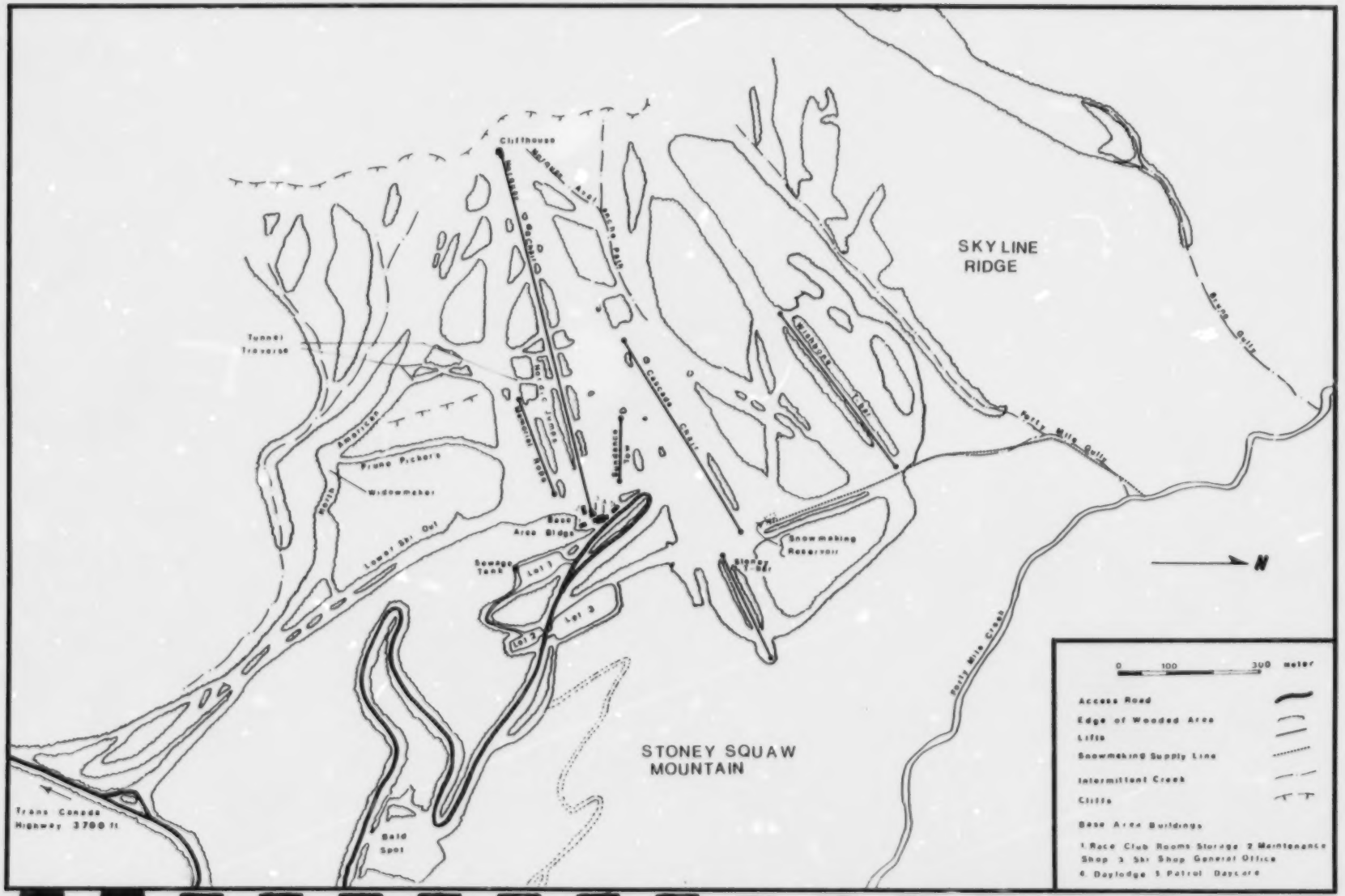
Lift	Vertical Rise(m)	Length (m)	Capacity: Passengers/ Hour
Norquay Chair	396	945	800 (Winter) 180 (Summer)
Cascade Chair	122	580	1,074
Wishbone T-Bar	107	487	900
Stoney T-Bar	56	243	800
Sundance Tow	41	183	643
Memorial Rope Tow	67	220	N/A
TOTAL	781		4,217 (Winter) 180 (Summer)

There are two lodge facilities at the Mount Norquay Ski Area. The base lodge has a cafeteria which seats about 180 people, a lower level lunchroom which seats about 50 people, and a warming area. The Cliffhouse, located at the upper terminal of the Norquay chairlift, seats about 80 people.

A number of smaller buildings provide support services. An industrial trailer complex adjacent to the base lodge houses the ski patrol, ski school and nursery, as well as a small boot change and locker room. Another building situated at the base of the Norquay chair houses the ski shop, ticket sales and management offices. Maintenance activities are housed in a workshop located adjacent to the Norquay chair terminal.

There are two ski jumps at the ski area, upgraded in 1985 to meet F.I.S. (Federation Internationale de Ski) competition standards for 40 m and 60 m jumps. These jumps complement the 70 and 90 m Olympic standard jumps at Canada Olympic Park in Calgary.

Figure 6: Mount Norquay Ski Area: Existing Facilities
(Source: Banff Lifts Limited, 1988)



A small snowmaking system was first installed at Mount Norquay in 1979, providing better snow cover for approximately 14 hectares of the higher skier density areas of the Cascade chairlift, the lower Cascade run, the Tunnel traverse and beginner area. Expansion of the snowmaking system has continued and now services about 20 hectares.

Water for snowmaking is supplied by three wells which can produce up to 230 l/minute; and by pipeline from Forty Mile Creek which produces up to 500 l/minute (Banff Lifts Limited, 1988). A 2 million litre underground concrete tank located near the bottom of the Cascade Chair serves as a storage reservoir for the snowmaking system.

In the past, domestic water supply to Mount Norquay has been problematic. Currently, a 10 m well in the Memorial lift building provides water for a 50,000 l underground reservoir located at the top of the Memorial rope tow. Current flow appears to meet the existing demand.

A septic tank and field are located south of Parking Lot One. Cliffhouse sewage is discharged into the base area system through a discharge line that runs down the mountain adjacent to the Norquay chairlift. Although the low water use vacuum toilet and wastewater system reduces water demand the existing waste water treatment and disposal system is inadequate. Regardless of future development, the sewage disposal system requires upgrading or replacement.

Solid waste is transported to the Banff town disposal facility.

Most of Mount Norquay's seasonal staff reside in housing provided by Banff Lifts Limited in Banff. Others live elsewhere in Banff or Canmore. There is one small apartment in the Mount Norquay base lodge which houses a watchman.

Summer operation for sightseers has been an important facet of the economic viability of the Mount Norquay Ski Area operation. The Cascade chairlift is retrofitted with gondola cars for summer riders. During the summer about 20,000 people ride the gondola (B. Fodor, pers. comm.). Some hang gliders use the gondola to access their take-off site. The Cliffhouse restaurant is open for visitors' convenience, and ticket and souvenir sales are handled in the ski shop building.

3.4 PROPOSED EXPANSION - THE LONG RANGE PLAN

3.4.1 Summary of Proposed Expansion

The long range plan for the Mount Norquay Ski Area is presented in Banff Lifts Limited's 1988 "Plan for the Improvement and Expansion of Mt. Norquay Ski Area" which proposes the expansion and/or upgrading likely to be considered within the next 10 to 15 years. A summary of the proposed developments follows (Figure 7).

a) Lifts

The Mount Norquay Ski Area now has six lifts. The development plan proposes the addition of two or three new lifts and extension, upgrading and relocation of the existing lifts :

(1) One or two new lifts will be constructed to service new terrain on Skyline Ridge.

(2) The Wishbone T-bar will be upgraded to a chairlift, and extended an additional 85 vertical metres.

(3) A new lift may be constructed south of the Norquay chair to service the Rock Garden and Memorial slopes.

(4) The Sunshine Handletow will be relocated closer to the new Daylodge location.

(5) The Stoney Squaw T-Bar will be relocated approximately 150 m north of its current position.

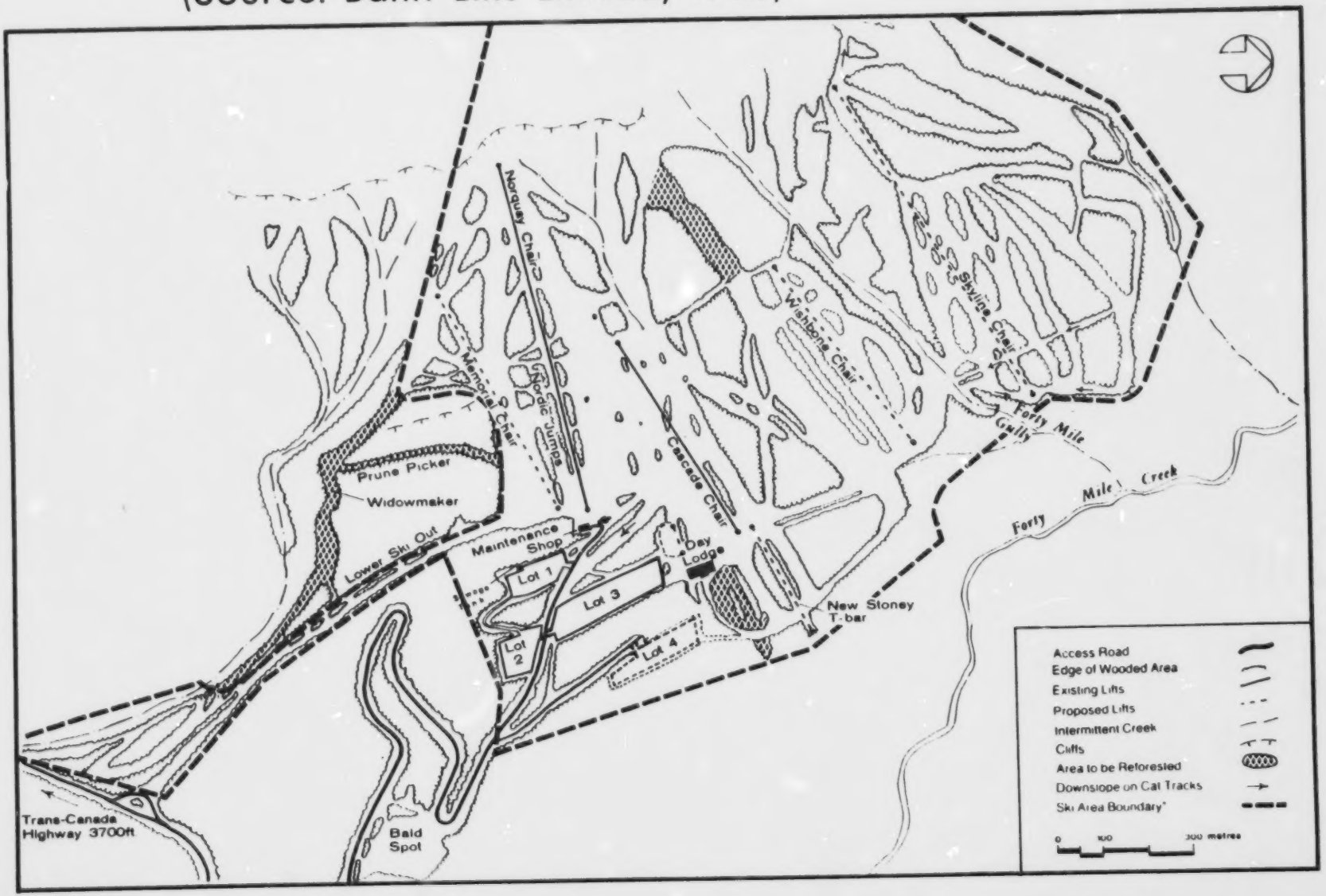
b) Ski Runs

Three important modifications are proposed for ski terrain :

(1) Skyline Ridge will be developed for skiing. A series of intermediate runs will be prepared on the north slope of the ridge, running into Bruno avalanche path. Skiers will return to the lift(s) base(s) on a traverse (cattrack) to be constructed along the lower slopes. More challenging runs will be developed along the east and south-facing slopes of Skyline Ridge. Configuration of runs and cattracks has not been determined at this time. Approximately 17.4 hectares of new ski runs would be added with tnis expansion.

(2) One new trail would be cleared on Stoney Squaw, north of the existing ski runs. The south trail on Stoney Squaw would be abandoned and reforested.

Figure 7: Mount Norquay Ski Area: Proposed Expansion
(Source: Banff Lifts Limited, 1988)



(3) The existing North American run on the south-facing slope of Mount Norquay will be abandoned and allowed to rehabilitate.

c) Support Facilities

Support facilities are to be upgraded.

(1) A new daylodge is to be constructed near the north end of Parking Lot 3.

(2) The maintenance building will be relocated into the parking lot behind the existing daylodge.

(3) Parking lots One, Two and Three will be expanded. A new parking lot may be constructed east (uphill) of Parking Lot Three.

(4) The snowmaking system is to be expanded/upgraded to include all high skier density areas and the new ski terrain on Skyline Ridge.

3.4.2 Analysis of the Proposal

The Mount Norquay development proposal clearly identifies the shortcoming of the existing ski area - lack of intermediate ski terrain - and proposes actions intended to overcome it. All of the components of the development plan are aimed at increasing the amount and variety of intermediate level skiing available to patrons of the ski area with increased supporting facilities.

The plan is conceptual and provides only enough information to assess on a very general basis the environmental impacts associated with the development proposal. Operational and economic viability of the proposed ski area development are the responsibility of the proponent and are not addressed in this IEE.

3.4.3 Preconstruction Requirements

Past experience, both at Mount Norquay and other national park ski areas, shows the importance of careful preplanning and the need for a "balanced" proposal where each element is consistent with other components of the plan. On a number of occasions facilities have been built which subsequently required significant environmental impact to make them operationally viable or safe. Numerous incidents of avoidable impact resulting from careless and/or unplanned site preparation have occurred.

The Mount Norquay development proposal is conceptual. Detailed site planning is required to determine the magnitude of the environmental impacts which will result from plan implementation and to assess the acceptability of the plan components. Prior to any terrain disturbance, detailed and comprehensive site development plans and specific development agreements must be prepared so the environmental effects of implementation can be examined and rehabilitation and other impact mitigating measures considered. Additional preconstruction activities will include surveying, development of access, and design of facilities and required site modifications. For development occurring within the existing ski area, environmental impacts from preconstruction activities will be minimal. For development on Skyline Ridge some forest clearing for surveys and to permit detailed planning and access may be required.

3.4.4 Construction Requirements

Construction of new facilities and development of new ski terrain will require forest and shrub removal, terrain reshaping, and rehabilitation of damaged vegetation and bared soils. Access for heavy equipment (bulldozers, backhoes, graders, dump trucks, cranes, front-end loaders, etc.) and a variety of small equipment (pick-ups) will be required. Air access by helicopter will be necessary to deliver equipment and structural materials to sites where ground access is difficult. Installation of support facilities - water systems for domestic and snowmaking use, sewage effluent gathering and holding systems, electrical services, avalanche control structures, and visitor amenities - will require terrain disturbance. Road access to lift bases will be required. The development of new runs will require vegetation removal and terrain reshaping. Destumping and bulldozing to prepare smooth runs will require cautious application and vigorous rehabilitation.

3.4.5 Operation and Maintenance

Operating a ski area in the winter involves maintenance and operation of the lifts and snowmaking equipment. Snow grooming is an important activity, especially at Mount Norquay where natural snowfall is limited and artificial snow is used. Services - sewage disposal, water supply, solid waste disposal and snow removal on roads and parking lots - require continuous attention. Food and beverage preparation and service are integral to the economic success of the area and provide an important visitor service.

At Mount Norquay an avalanche forecasting and control program will continue to be an important part of the operation.

About 50 employees (some are part-time) are required to maintain the present winter operation at Mount Norquay (not including Warden Service staff currently involved in avalanche control). If the long range proposal is implemented, approximately 70 staff will be required.

Summertime activities at Mount Norquay involve overhaul and major maintenance of lifts and machinery, improvements to ski runs and upgrading of the snowmaking system. Rehabilitation has been an important activity since 1979. In addition to these "housekeeping" activities, the Norquay gondola operation provides summer visitors with rides to the Cliffhouse where a cafeteria, souvenir stand and washroom facilities are all available. About six staff are employed for the summertime operation (B. Fodor, pers. comm.).

3.4.6 Abandonment

Occasionally, facilities, structures or previously used areas are rendered obsolete or non-functional as a result of changes in use patterns. An important element of the ski area development plan is abandonment of runs (North American and Prunepickers) on the south-facing slope of Mount Norquay. As well, a run on Stoney Squaw will be abandoned. Rehabilitation objectives and plans for these sites have not yet been developed.

BLL proposes to discontinue operation of the summer gondola which will reduce summer visitation to the area. As the Norquay lift will still be operated in the winter, no facility abandonment is expected to result from this change.

Relocation of the lodge and associated facilities will require aggressive rehabilitation of the abandoned site. Removal and clean-up of structures and restoration of soil and vegetation are integral to the construction of replacement facilities. In the past few years, Banff Lifts Limited has exhibited commendable success with rehabilitation of impacted sites and reforestation of previously cleared areas. Continuing dedication to this aspect of ski hill management will be needed.

PART 4

EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS

The natural and cultural resources in and near the Mount Norquay Ski Area are described in this chapter. Each section describes a particular resource, and explains the implications of various ski area development proposals which relate to that resource. Options for avoiding and for mitigating the threatened impact are presented. In many instances, Banff Lifts Limited has responded to previously identified significant impacts by revising the proposal. Those changes are discussed as examples of environmental protection measures already incorporated into the development plan.

The source of much of the description of existing natural resources is the Ecological (Biophysical) Land Classification of Banff and Jasper National Parks, 3 volumes (Holland and Coen eds., 1982 and 1983; and Holroyd and Van Tighem, 1983). When more specific plans are available, detailed site examination will be required to further evaluate environmental impacts, identify mitigating measures, and determine the acceptability of specific proposals.

In the Biophysical Land Classification 124 types of land units called "ecosites" are mapped.* Thirteen different ecosite types occur on Mount Norquay and the adjacent area. Each ecosite has a characteristic set of natural resources including landform, soil and vegetation. Figure 8 illustrates the study area, and indicates the ecosites which occur in it.

The resource characteristics found in the ecosites mapped in the Mount Norquay area are summarized in Table 3.

4.1 Climate

4.1.1 Existing Conditions

Daily winter weather records have been maintained at the Mount Norquay Ski Area since 1970 as part of the avalanche

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* The Biophysical Land Classification describes resource characteristics in a hierarchical system. The "ecoregion" is the largest unit, differentiated on the basis of climatic factors. Each ecoregion is subdivided into "ecosections" which are differentiated by landforms. Each ecosection contains one or more "ecosites", differentiated from other ecosites by variations, primarily in vegetation type.

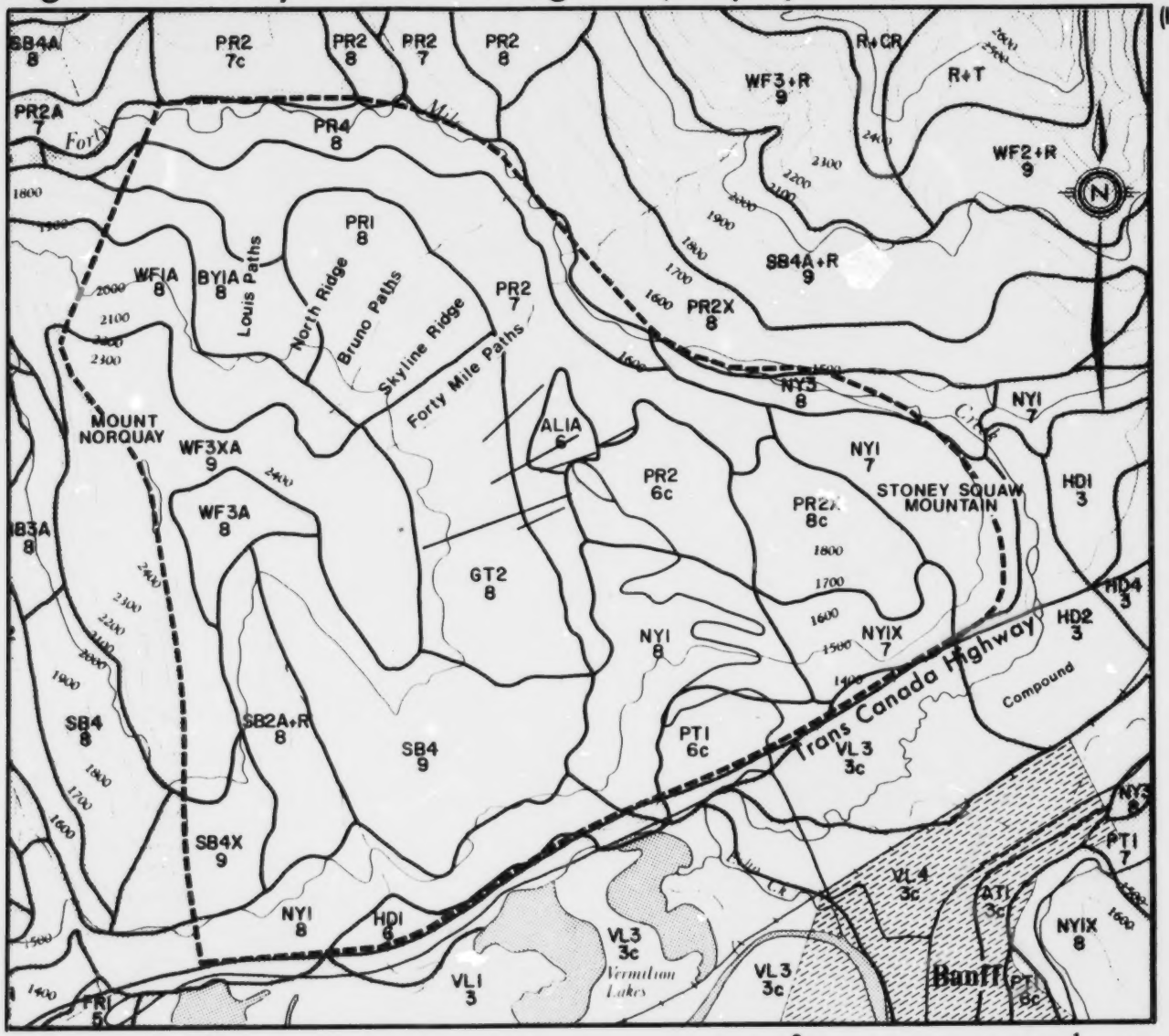
Table 3

General Features of Ecosites in Mount Norquay Ski Area
(Source: Holland and Coen, 1982)

Ecosite	Landform	Soils	Vegetation	Comments (Also see Figure 8)
AL1- (Altrude) (Lower Subalpine)	-fluvial fans and aprons -calcareous, coarse stratified material -relatively stable	-Orthic and Eluviated Brunisols -well drained	-lodgepole pine forest	-a small area at base of Wishbone chairlift -this site has been modified by snow avalanching and run clearing
BY1 (Bryant) (Lower Subalpine)	-blankets of calcareous, medium-textured till over inclined bedrock, frequently with veneer of eolian material	-Eluviated Eutric Brunisols	-Engelmann spruce subalpine fir forest	-mid slope on north slope of Mount Norquay
GT2 (Goat) (Lower Subalpine)	-inclined and ridged -morainal landforms -calcareous, medium textured till	-Eutric Brunisol -Regosolic	-lodgepole pine	-located above existing ski lodge where most existing runs are located (Lone Pine, most of Wishbone area) -modified by run clearing
HD1 (Hillsdale) (Montane)	-fluvial fans and aprons -calcareous, coarse stratified material -usually channelled	-Regosolic	-aspen	-small area at the base of Mount Norquay, above Second Vermilion Lake
NY1 (Norquay) (Montane)	-blankets and veneers, often gullied, of calcareous, medium-textured till	-Eutric Brunisol where stable -Regosolic -rapidly to well drained	-Douglas fir forest -lodgepole pine forest -small patches of grassland	-southern and eastern slopes of Stoney Squaw Mountain, south-eastern slope of Mount Norquay, including portions of the existing North American run and access road to ski area
NY3 (Norquay) (Montane)	-inclined gullied and hummocky calcareous variably textured ice contact stratified drift	-Orthic and Eluviated Brunisols -Orthic and Cumulic Regosols	-white spruce/ Douglas fir forest -lodgepole pine forest	-valley bottom below north slope of Stoney Squaw Mountain
PR1 (Panorama) (Lower Subalpine)	-blankets of calcareous, medium-textured till over inclined bedrock	-Orthic and Eluviated Brunisols	-lodgepole pine forest	-North Ridge, Skyline Ridge
PR2 (Panorama) (Lower Subalpine)	-as above	-as above	-as above (with different understory vegetation)	-includes the existing ski lodge area and western slopes of Stoney Squaw Mountain. -lower slopes of Mount Norquay
PR4 (Panorama) (Lower Subalpine)	-calcareous medium-textured till or calcareous, variably ice contact stratified drift on slopes formed by creek erosion	-Eluviated Eutric Brunisols	-Engelmann spruce/ subalpine fir forest	-valley floor of Forty Mile Creek
PT1 (Patricia) (Montane)	-ridged or hummocky moraine or morainal blankets overlying ridged or hummocky bedrock: calcareous, medium-textured till	-Brunisolic -Luvisolic	-lodgepole pine forests	-includes a small area near base of existing North American run along Trans Canada Highway
SB2 (Sawback) (Lower Subalpine)	-blankets and aprons of calcareous, medium textured colluvium overlying inclined bedrock -relatively stable	-Brunisolic -Regosolic	-avalanche complex	-includes portions of eastern slopes of Mount Norquay. This particular ecosite is modified by frequent snow avalanche and has more than 50% consolidated bedrock within 10 cm of surface.
SB4 (Sawback) (Lower Subalpine)	-shallow, discontinuous colluvial landforms of calcareous, medium-textured colluvium, with patches of exposed bedrock.	-Brunisolic -Regosolic	-coniferous open forests	-includes a large part of the southeastern slope of Mount Norquay.
WF3 (Wildflower) (Upper Subalpine)	-as above, with frequent exposed bedrock escarpments	-as above	-mixed coniferous open forest; avalanche complex.	-includes upper slopes and top of Mount Norquay. These particular ecosites have been modified by frequent avalanche activity and much of the area is consolidated bedrock within 10 cm of the surface.

Figure 8: Study Area Ecological (Biophysical) Land Classification

(Holland and Coen, 1982)



contour interval – 100 metres
contours are approximate due to metric conversion

0 1 Miles
0 1 Kilometres

Legend

- Study Area Boundary
- Existing Ski Lifts
- Trails
- Intermittent Streams

Ecosite Symbol — Modifier

PL4A
5

Slope Class

Ecosite Symbols

See Table 6 for ecosite descriptions

Modifiers

A	Snow Avalanched
X	Lithic
R	Rock

Slope Classes

Symbol	% Slope
3	0 - 5
5	5 - 15
6	15 - 30
7	30 - 45
8	45 - 70
9	> 70

c after symbol denotes complex slope

control program carried out by the Banff National Park Warden Service. As well, the study area is close to the Banff town weather station and data collected at that location has good relevance to the Mount Norquay area. Tables 4 and 5 present climatic data from Mount Norquay, with data from Banff and Sunshine Ski Area included for comparison.

As a general rule, air temperature decreases with elevation. Occasionally, however, the temperature increases with elevation (inversion). This may occur overnight when a shallow layer of air near the ground is cooled by radiative cooling. More persistent deep inversions are associated with cold Arctic outbreaks. Figure 9 illustrates four specific cases that demonstrate the temperature differences during cold outbreaks at different elevations and locations. The air at lower elevations cools more during cold outbreaks and does not warm as rapidly or as much during moderating periods (Kociuba, 1989).

The aspect (direction a slope faces) is also important in determining the air temperature. As a general rule, south- and west-facing slopes tend to be warmer than corresponding east- and north-facing slopes. Existing ski slopes in the study area have variable aspects. Mount Norquay slopes face mostly south and east; Stoney Squaw Mountain ski slopes face west; and Skyline Ridge slopes face mostly north and east.

4.1.2 Implications of Development

Changes proposed for the Mount Norquay Ski Area will not have a regionally significant influence on the climate although the microclimate of some areas will be changed. Timber and brush removal will result in changes in snow accumulation, shadowing, air movement, and radiation.

Mount Norquay experiences the mildest climatic conditions of any of the four ski areas in Banff and Jasper national parks. This has both advantages and disadvantages to ski area development.

The primary disadvantage of the mild climate is lack of snow, which results in a short ski season and poor skiing conditions. About 50% of the precipitation in Banff town, near the study area, falls as snow (Atmospheric Environment Service, 1981). In comparison, other ski areas at higher elevations have a larger proportion of snowfall. At Lake Louise, for example, nearly 70% of the precipitation arrives as snow (Leeson and Israelson, 1982). The consistently poor skiing conditions caused by inadequate natural snowfall, direct radiation, low elevation and warm temperatures on ski terrain on the south-facing slope of Mount Norquay have

Table 4

Mean Monthly Temperatures (C^{o})

Mount Norquay Ski Area

	November	December	January	February	March	April
1970-71	---	-10	-12	- 5	- 5	+ 1
1971-72	- 2	-13	-16	-10	- 1	- 2
1972-73	- 4	-11	- 9	- 6	- 2	0
1973-74	- 9	- 6	-12	- 5	- 5	+ 1
1974-75	- 2	- 5	-10	-14	- 6	- 4
1975-76	- 6	- 9	- 8	- 5	- 6	+ 3
1976-77	- 5	- 6	-10	- 3	- 4	0
1977-78	- 8	-12	-12	- 7	- 3	---
1978-79	-11	-12	-16	-10	- 3	- 2
1979-80	- 6	- 7	-14	-10	- 5	+ 1
1980-81	- 4	-10	- 6	- 6	- 2	- 2
1981-82	- 2	-11	-16	-10	- 7	- 6
1982-83	-10	-10	- 7	- 4	- 4	- 3
1983-84	- 4	-18	- 8	- 4	- 3	- 1
1984-85	- 8	-15	-10	-11	- 5	0
1985-86	-20	- 8	- 5	-11	- 2	---
1986-87	- 9	- 8	- 7	- 5	- 4	+ 2
1987-88	- 2	- 9	-12	- 8	- 3	+ 1
Averages:						
Mt. Norquay	- 6.7	-10.2	-10.7	- 7.6	- 3.9	- 1.0
Sunshine[1]	- 9	-11	-13	-10	- 8	- 4
Banff Town[2]	- 3.9	- 8.9	-11.5	- 6.3	- 3.4	+ 2.4

[1] Warden Service, Banff National Park
[2] Atmospheric Environment Service, Environment Canada

Table 5

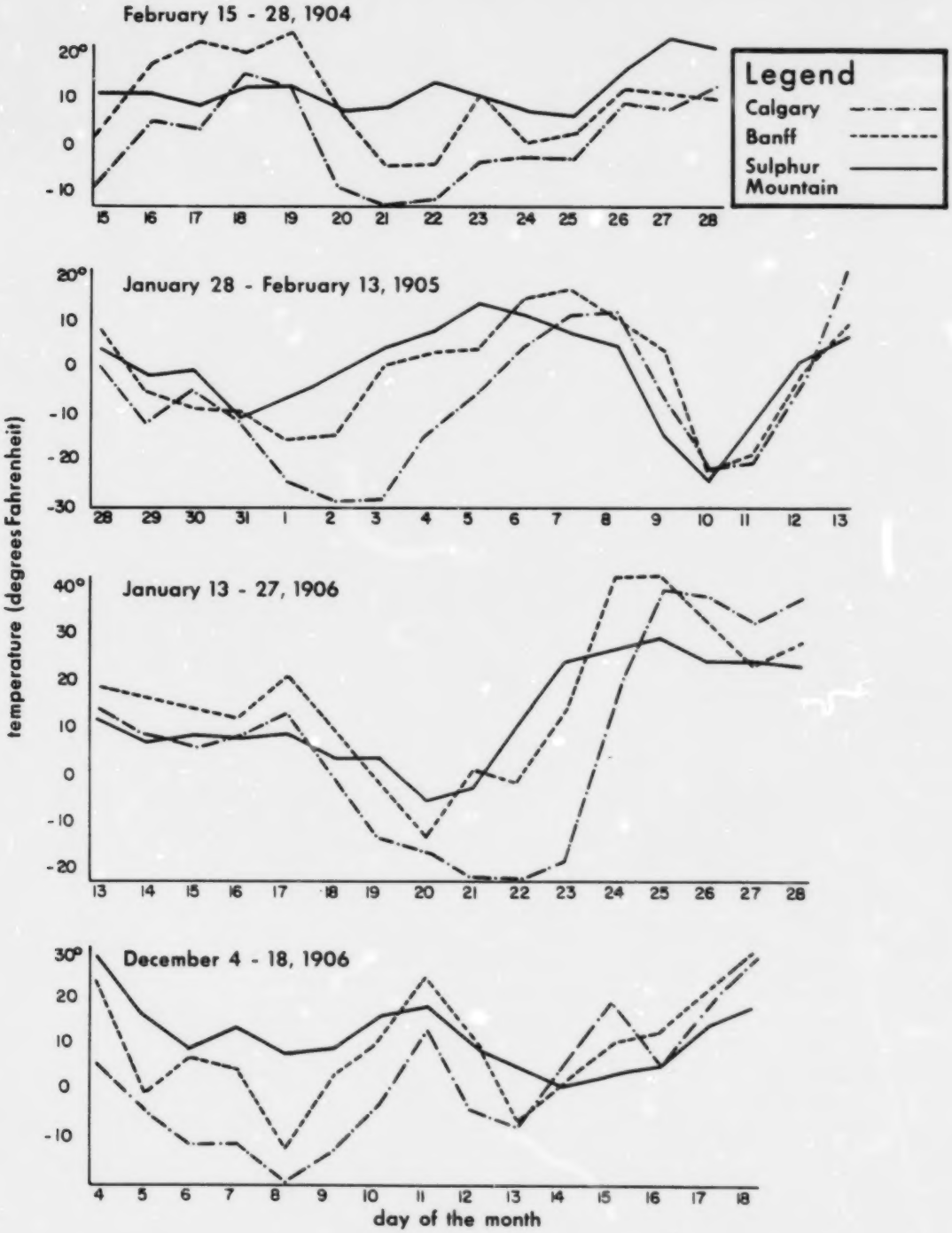
Total Monthly Snowfall (cm)

Mount Norquay Ski Area[1]

Season	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total	Banff Town Total	Sunshine Total
1970-71	---	83	151	29	89	26	378	271	893
1971-72	22	95	121	182	64	47	531	455	791
1972-73	8	118	33	44	29	73	305	322	602
1973-74	68	32	137	34	53	6	330	392	774
1974-75	54	51	27	66	21	17	236	217	575
1975-76	23	137	20	24	59	20	283	263	737
1976-77	28	37	34	13	53	3	168	194	414
1977-78	77	74	34	10	27	---	222	268	558
1978-79	71	45	11	77	24	48	276	277	562
1979-80	1	111	38	31	69	9	259	230	630
1980-81	101	85	11	32	25	6	260	242	567
1981-82	18	46	73	40	107	40	324	229	581
1982-83	40	30	70	10	45	10	206	142	477
1983-84	24	25	52	37	51	2	190	160	479
1984-85	32	85	2	19	26	8	173	133	483
1985-86	53	5	42	52	27	---	180	156	478
1986-87	120	7	36	29	76	---	268	176	545
1987-88	10	69	39	27	32	21	198	145	600
AVERAGE	44	63	52	42	49	22	266	237	597

1. Warden Service, Banff National Park
2. Atmospheric Environment Service, Environment Canada

Figure 9: Temperature Inversions — Banff Area — 1904 —1906 (adapted from: Stupart, in Janz and Storr, 1977)



contributed to the decision to remove the North American run from the ski area. Elsewhere in the ski area artificial snowmaking has improved skiing conditions on existing ski slopes, and will be an integral component of development of new ski terrain on Skyline Ridge. Environmental impacts associated with snowmaking are discussed elsewhere in this document.

An advantage of the milder climate is that revegetation is more easily accomplished than in the harsher climates at higher altitudes. Where erosion has been controlled at Mount Norquay and where soil moisture is sufficient, revegetation of previously disturbed sites has been successful.

The importance of the study area to wildlife, especially during the winter, is partly attributable to the relatively mild climate.

Theories proposing that global climate is warming because of atmospheric changes (ie. the "Greenhouse effect") suggest that snow conditions at ski areas may change in upcoming decades. Because of the cyclical nature of weather patterns and insufficient data to identify long-term trends, if and how this climate change could affect the Mount Norquay Ski Area is unknown.

4.2 GEOLOGY AND LANDFORMS

4.2.1 Existing Conditions

Mount Norquay is located in the Front Ranges of the Rocky Mountains. Exposed bedrock materials in the area are a variety of limestones and dolomites laid down in the Paleozoic and Mesozoic eras (Price and Mountjoy, 1972). The youngest of these, the Sulphur Mountain Formation, underlies much of the existing ski area including the access road, lodge and present lifts. The dominant siltstone and shale of this formation weather recessively, and therefore tend to be obscured by vegetation (Nelson, 1970). These dark shaly rocks are apparent in the cuts made by the access road and extend all the way down to the Trans-Canada Highway (Baird, 1967).

In two locations in Banff National Park this formation contains Triassic fish fossils which are rare and of scientific value. This type of fossil is "known from only a limited number of sites worldwide (Schaeffer and Mangus, 1976), and the good quality of preservation makes these sites even more significant (Wilson, M.V.H., 1986)" (Achuff, Pengelly and White, 1986).

Rocks of the Rocky Mountain Group are exposed along the lower slope of Stoney Squaw Mountain, along parts of the North American run, and extend from above the ski lodge down to the Trans-Canada Highway. Some of the materials exposed in this formation - quartz sandstone, phosphatic siltstone and chert, in particular - have characteristics which were attractive to prehistoric tool makers. Quarry sites of indigenous peoples have been found throughout the Bow Valley in this formation, including sites on Stoney Squaw Mountain.

The Mount Norquay Ski Area and Banff town are located in the most constricted portion of the lower Bow Valley. The townsite is situated on the valley floor and the ski area occupies northern slopes of the valley. Typically, the slopes of Mount Norquay are steep. The upper 300 meters or so of Mount Norquay are cliffs. In general, the ski slopes range between 45% - 70%. The area presently occupied by the base lodge and parking lots is rated in a slope class encompassing slopes of 15% - 30%. Slopes on Stoney Squaw Mountain are complex, and typically 15% - 30% (Holland and Coen, 1982).

Landforms in the area reflect the geomorphic processes which have molded them. The steepest areas are primarily colluvial landforms, resulting from the effect of gravity as the major modifying agent. The SB2, SB4, and WF3 ecosites which are found from the peak of Mount Norquay (2,322 m) to about 2,100 m, are covered with calcareous, medium textured colluvium. Patches of bedrock are frequently exposed and consolidated bedrock is often close to the surface. These sites are modified by frequent snow avalanche activity (Holland and Coen, 1982).

Much of the study area lies on morainal landforms. The material which blankets the slopes of Mount Norquay and Stoney Squaw Mountain was deposited by glacier ice. These morainal blankets and veneers are composed of calcareous till material and are frequently inclined and hummocky (Holland and Coen, 1982) (Figure 8, Table 3). The morainal landforms in the Mount Norquay area appear to be relatively stable and somewhat resistant to slope failure. This is due to the generally low groundwater conditions of the area.

A small area (Ecosite AL1 in Figure 8) at the base of the Wishbone chairlift is a result of material deposited by running water. This fluvial landform is composed of calcareous, coarse stratified material which is relatively stable at present (Holland and Coen, 1982). This is one of the flattest locations in the study area.

4.2.2 Implications of Development

There are four special geological/landform circumstances at Mount Norquay which relate to ski area development : potentially significant geological resources, importance of geological materials to prehistoric cultures, the topographic position of the area and its relationship to wildlife movement routes, and ski terrain potential of the slopes.

There is some potential for impact to significant fossils where construction of traverses and siting of facilities will disturb bedrock. It "is entirely possible that fish fossils will be found, though the pattern of finds to date would suggest that they would not be abundant" (Wilson, M.C., 1986). Minimizing the potential impact to this special value will consist primarily of limiting bedrock disturbance and, where disturbance does occur, conducting a careful search for noteworthy fossils by qualified personnel prior to and during construction, and salvage of material as appropriate.

Because the rocks in the Rocky Mountain Group were attractive to prehistoric cultures, any terrain disturbance along the lower slope of Stoney Squaw Mountain must be done with advice from competent archaeologists.

The third issue, topographic position of the area and its importance as a wildlife movement corridor, is discussed in Section 4.6 which deals with implications of ski area development to ungulates.

The Mount Norquay Ski Area lacks intermediate ski terrain. The development plan, therefore, proposes expansion onto slopes which could be developed to provide more suitable terrain for intermediate skiers.

Minimizing terrain impacts related to development of the Mount Norquay Ski Area has been achieved largely through modification of previous development plans. Previous proposals included construction of ski terrain on Stoney Squaw Mountain and removal of the bedrock ridge on which the existing lodge is located. Serious terrain impact was associated with those plan elements. Therefore, they have been deleted from the current development proposal.

Remaining elements of the plan which will result in terrain impacts include the construction of traverses (cattracks) for skier access to and across slopes on Skyline Ridge, preparation of terrain for skiing, installation of a snowmaking system, lift and building construction, and parking lot addition and expansion.

Development of ski terrain on Skyline Ridge will require the construction of a cattrack to allow skiers to return to the lift terminal from ski runs in Bruno avalanche gully. Although the traverse could be partly contiguous with the existing Forty Mile Creek cross-country ski trail, a significant amount of terrain reshaping might be required.

The significance of the terrain disturbance caused will relate directly to the width of the traverse necessary to provide sufficient capacity for returning downhill skiers. In addition, some method, probably terrain recontouring, will be required to soften the transition between the relatively steep runs coming off the slope and the relatively flat traverse running at right angles to the runs.

A number of circumstances work to ameliorate impacts resulting from construction of a low elevation traverse. No bedrock exposure is evident in the area likely to be recontoured, so little blasting or exposure of bedrock is anticipated. If the traverse were located on the stable, gently sloping bench at the bottom of the steeper slopes of Skyline Ridge, the extent of recontouring required to level the site would be minimized. The traverse would be partly contiguous with an existing trail which would provide at least some of the required trail base. The visual impact of the cattrack construction would be minimized because it is located in mature forest and will not be visible from areas of high visitor use. Prior to any development of the Skyline Ridge area, it must be clear that a traverse of sufficient capacity to provide for returning skiers can be constructed without significant terrain disturbance.

A higher elevation traverse crossing the Forty Mile avalanche path would be more problematic. It would be situated in an area with significant bedrock exposure where steep slopes provide no opportunity for taking advantage of a natural bench to locate the trail. These unstable landforms are susceptible to snow and rock avalanche. If situated above treeline, the cattrack would not be screened by vegetation, so the horizontal, straight-line image of the bench would be highly visible. Even with the application of a number of techniques including the use of downslope retaining walls rather than standard cut and fill construction, a high elevation traverse would have significant environmental impact.

Other components of the development plan will also cause land disturbance. To make the floor of the Bruno avalanche gully suitable for skiing, substantial recontouring will be required to level the rough topography of the gully. This area is subject to significant natural disturbance - snow avalanching in winter and flash floods and debris flows during other seasons. Removal of bedrock outcroppings in the gully should be avoided as these ribs dissipate the energy of the intermittent stream and moving colluvial material.

Installation of new lift terminals and lift towers will result in terrain impact. The unreclaimed and unstable cut slope behind the upper terminal of the Cascade chair is an example of terrain damage which can occur with environmentally unsympathetic lift construction. Terminals for the new lift(s) which will service Skyline Ridge should be located on relatively flat ground to minimize cut and fill requirements. If a lift is constructed across the Forty Mile Creek avalanche gully, an area will be required for chair storage. (Because of the avalanche exposure of a lift traversing the gully, chairs must be removed during periods of high avalanche hazard.) The amount of terrain recontouring required to prepare a stockpile area of sufficient size is unknown. Lift towers will require some terrain disturbances at their bases, but impacts should be minimal.

Road access across Forty Mile avalanche gully will likely be required to provide vehicle access to lift terminals on the Skyline Ridge. This will require terrain disturbance, although unlikely to be more severe than typically permitted in National Park ski areas.

Upgrading and expanding the snowmaking system will entail substantial trenching. Although terrain disturbances during pipeline installation will be considerable, thoughtful site selection, construction practices, erosion control and rehabilitation will mitigate potential terrain impacts. Previous snowmaking system installation at Mount Norquay has been successful in minimizing impacts related to the terrain disturbance.

Limited expansion of existing parking lots can probably be accomplished with an acceptable level of terrain manipulation. Construction of the proposed new Parking Lot 4 will be complicated by bedrock exposure and the complex topography of Stoney Squaw Mountain.

Construction of the new daylodge and maintenance facilities will require terrain impacts for foundation development although this is expected to be straightforward and achievable with normal construction techniques.

The current development plan (Banff Lifts Limited, 1988) avoids many of the significant terrain impacts associated with elements of previous plans (eg. extensive ski terrain development on Stoney Squaw Mountain). However, as disturbance to landforms and underlying geological resources is essentially irreversible, activities causing terrain impacts must be examined with particular care and only permitted after cautious consideration.

Terrain recontouring for a high level traverse could have significant environmental impacts. Otherwise, terrain impacts associated with Banff Lifts Limited's concept do not preclude further consideration of the development plan. Prior to any terrain disturbance, detailed site plans must demonstrate :

a) that the significance of geological and archaeological resources is assessed and any special features are protected appropriately;

b) the total extent of terrain disturbance required to service projected skier numbers and operational requirements;

c) that rehabilitation plans are in place (this is a requirement stipulated in the Management Framework (Environment Canada, 1986)); and

d) that scenic values will be protected.

4.3 SOILS

4.3.1 Existing Conditions

Soils in the area affected by the Mount Norquay development plan are primarily of two soil orders - Brunisolic and Regosolic (Holland and Coen, 1982). Regosolic soils occur where soil disturbance is frequent, as happens on steep slopes where soil creep and downslope movement result in continuous profile disruption. Many slopes on Mount Norquay are steep and as a result Regosolic soils are very common.

Brunisolic soils are also common. These soils occur where soil weathering has been restricted by climate - for example, by long winters and low temperatures. They develop under varying forest, alpine or tundra vegetation, and are well to imperfectly drained. Eutric Brunisols are particularly common, associated with the calcareous geomorphic parent materials of the area.

Gray luvisols are associated with Brunisolic soils in the PR2 ecosites which occur on the lower slopes of Mount Norquay and Stoney Squaw Mountain. Luvisolic soils commonly develop in calcareous glacial and glaciolacustrine materials and are rapidly to moderately well drained. They tend to occur under lodgepole pine forests in the lower subalpine and montane, where it is warm and dry.

There is little evidence of soil failure and slumping in the existing ski area, despite the fact that many slopes are steep. This stability is likely attributable to the relatively dry soil conditions.

Soil fertility tests have been conducted to determine nutrient requirements for rehabilitation of existing disturbed sites. These tests indicate low fertility. In addition, free lime content is very high which further reduces nutrient availability (Table 6).

Soil depth throughout most of the existing ski area has been sufficient to permit mechanical stump removal, pipeline burial and slope recontouring without bedrock exposure.

Based on site reconnaissance, soil depth on the Skyline Ridge appears to be similar to the existing slopes. An exception is the Bruno avalanche path, where coarse colluvial material and some bedrock ridges will create difficulties during slope preparation. The site proposed for new parking lot construction also has bedrock near the surface, which will complicate parking lot development.

Surveys of the existing ski area have been undertaken to determine the extent of existing impacts and to recommend rehabilitation measures (also see Section 4.4, Vegetation). Harrison (1984) discusses existing soil impacts in her impact inventory and rehabilitation plan for the ski area :

> Erosion control is required to enhance landscape stability on Norquay. Falling material, seeps and surface run-off are causing damage within the ski area. Sloughing of material is primarily occurring in areas where cutbanks have been improperly prepared. All material has a natural angle of repose. Where slopes are steeper than this angle, forces will work to amend the situation and reduce the slope. The result is the movement of material from one part of the slope to another. In most cases at Norquay, the problem can be solved by rounding off the top of cutbanks and removing overhanging materials. Once stabilization is achieved, revegetation can proceed. Where surface water flow is combined with steep slopes, rill or gully erosion can result. In several locations, most notably roads and trails associated with the Norquay chair, gully erosion is prominent. The depressed nature of the track tends to channel surface water flow and where a path with little resistance to the downhill flow is provided,

Table 6

Soil Test Reports, November and December, 1982
(Alberta Agriculture, Soil and Feed Testing Laboratory)

AVAILABLE PLANT NUTRIENTS[1]	LOCATION			
	Lone Pine Run	Mid North-American Run	Wishbone	Norquay Chair (Tunnel Cut)
Nitrogen[2]	4	1	5	10
Phosphorus[3]	0	0	1	0
Potassium[4]	116	196	108	113
Sulphur[5]	M-	M	M+	M
pH	7.7	7.7	7.4	7.7
Organic Matter[5]	L	L	L+	L+
Free Lime[5]	H+	H+	H+	H
Texture	sandy loam (coarse)	sandy loam (coarse)	sandy loam (coarse)	sandy loam (coarse)

1 Measured in pounds per 2 million pounds.

2 Rating : Low (0-20); Medium (21-50); High (51+).

3 Rating : Low (0-25); Medium (26-50); High (51+).

4 Rating : Low (0-150); Medium (151-300); High (301+).

5 H : High; M : Medium; L : Low.

problems develop. The worst erosion is occurring on hiking trails below the Cliff House. These trails parallel the fall-line and capture surface water flow. Additional impact occurs where the water escapes from the track onto the surrounding terrain. Erosion and downslope sediment wash occurs, expanding potential impact. Lateral erosion control, such as water bars, must be constructed in such areas. Less severe surface wash or subsurface seep may be ameliorated with the use of erosion control fabric such as hold 'n gro. These areas must first be scarified to remove surface channeling. Trails or roads which are no longer required should be recontoured and where possible brought up to the level of the surrounding terrain with the addition of fill and soil. Steep slope disturbance rehabilitation will also require the placement of erosion control fabric.

4.3.2 Implications of Development

The soils in the Mount Norquay area appear to be inherently stable as no evidence of failed soils was noted during site visits. Soils disturbed for existing facilities and ski runs do not exhibit a tendency to slump and there is no indication that further facility expansion will encounter different circumstances. The addition of supplementary moisture to the slopes through artificial snowmaking will not require extraordinary construction methods to ensure continuing soil stability, unlike at the Lake Louise and Marmot Basin ski areas where soils exhibit inherent instability and where surficial disturbance frequently results in slope failure.

In general, soil depth appears to be sufficient for proposed activities to occur without extraordinary development difficulty. Lack of topsoil in the Bruno avalanche path and at the site of the proposed new parking lot are exceptions and will require special rehabilitation efforts to ensure revegetation and soil retention after disturbance.

In some areas, dry ravel of soils is evident where slope cuts have been made and adequate rehabilitation has not been undertaken. Cutbanks above the upper terminal of the Cascade chairlift, on the east side of Parking Lot 3, and along the lower North American run are examples. These circumstances could have been avoided if proper construction and rehabilitation methods had been employed in previous ski area development. They clearly demonstrate the difficulty in stabilizing and revegetating over-steepened slopes on these dry and infertile sites.

Because of steep slopes, erosion will be a problem wherever soil or vegetation is disturbed. Ski run cutting, terrain recontouring, installation of snowmaking equipment and water intakes, building and lift construction must employ methods and designs that will reduce soil impacts and erosion.

Banff Lifts Limited has undertaken an active rehabilitation program which has successfully addressed many of the problems identified by Harrison (1984). Some sites, such as the cut slope behind the Cascade chair upper terminal, a trail running downhill from the Cliffhouse, trampled terrain at the upper terminal of the summer gondola (Norquay chairlift), and cuts on the lower North American run continue to be unreclaimed, however.

Some concern has been expressed about soil contamination caused by using deicing salts to maintain roads (Westhaver, 1987). Little is known about the natural buffering capacity of local soils or the cumulative effect of continued road salting. Further investigation is required to understand the extent and seriousness of this impact at Mount Norquay, although reducing or eliminating road salting would clearly reduce this impact.

Some components of previous development plans for Mount Norquay would have had severe impacts to soils. Ski terrain development on Stoney Squaw has been deleted from the current development plan due, in part, to the severe, quarry-like impacts which would have resulted.

It appears that the proposals contained in Banff Lifts Limited's 1988 development plan will not result in such severe impacts to soils that further consideration of plan components is precluded. More detailed plans must clearly indicate the extent of the proposed disturbance, techniques which will be employed to minimize the disturbance and prevent erosion, rehabilitation methods and standards to be achieved. (The Rehabilitation Plan is a requirement of the Management Framework (Canadian Parks Service, 1986)).

4.4 VEGETATION

A number of statements in the Management Framework (Canadian Parks Service, 1986) emphasize the importance of protecting the national park's vegetation :

A high priority will be given to protecting species of vegetation that are endangered, rare, fragile or unique. Management and use activities will be limited by the fragility of surrounding vegetation, and the management of Parks must be carried out in a way that causes the least possible interference with natural vegetation.

. . . Limited in size, it [the Montane ecoregion] requires special management and extra attention to any activity with the potential to alter the Montane ecoregion directly or indirectly.

. . . Unique, rare, endangered species or associations between various kinds of vegetation will be identified so that appropriate measures can be taken to protect them.

. . . Because of the importance of the montane ecoregion for both resource protection and visitor use, special measures will be developed to minimize the harmful consequences of current or past uses.

. . . No activity that might harm vegetation can be approved before Rehabilitation Plans have been made.

4.4.1 Existing Conditions

The vegetation in the study area is an interesting and rich mosaic of plant associations that reflects differing environmental circumstances of elevation, aspect, succession and landform.

Human influence is evident in the vegetation associations of the study area. Most obvious, of course, are the ski runs where trees and shrubs have been removed to provide suitable skiing terrain. These runs are covered with a combination of native and agronomic herbs and grasses. In recent years, Banff Lifts Limited has undertaken a program of rehabilitation of damaged areas including planting tree islands. These efforts have been quite successful although some sites remain unreclaimed.

Fire has played a role in determining the existing vegetation associations. The lower Bow Valley has experienced more fires than any other area in the park, likely due to high human use (railroad, towns, etc.) (White, 1985). White's (1985) fire history of Banff National Park indicates that

major fires occurred in the study area in 1889 and 1923. (The 1923 fire was caused by logging activities.) Historically, fires were aggressively suppressed wherever they occurred within the park. This suppression of the natural fire cycle has interfered with the natural vegetation associations and it is now recognized that fire is an important component of vegetation succession. Therefore, the Management Framework (Canadian Parks Service, 1986) directs, "Parks Canada will manage and maintain areas of natural vegetation that depend on fire as part of their natural cycle."

From 1883 to approximately 1920, most of the lower Bow River Valley, including Mount Norquay and Stoney Squaw Mountain, was selectively logged. Occasional evidence of previous logging operations can be found throughout the study area.

At the highest elevations on Mount Norquay, severe growing conditions virtually preclude the establishment of vascular plants. In these upper subalpine areas (WF1 and WF3 ecosites), non-vascular plants are the most common, but even these plants are discouraged because of the highly calcareous nature of the bedrock material.

Most of the study area falls within the lower subalpine ecoregion which encompasses all the existing and proposed ski terrain. It includes the cliffs on Mount Norquay (approximately 2,150 m), where vegetation consists of scattered stands of Engelmann/white spruce (Picea engelmannii/P. glauca), white bark pine (Pinus albicaulis), subalpine larch (Larix Lyallii) and subalpine fir (Abies lasiocarpa). These stands have become established where the landform configuration provides some protection from avalanches originating in the cliffs above.

The vegetation of the Forty Mile and Bruno avalanche paths is a result of periodic disturbance by snow avalanching. It varies widely, from low lying sparse herb mats in the dry rocky upper levels of the paths to lush stands of willow (Salix spp.), birch (Betula spp.) and cow parsnip (Heracleum lanatum) in moist sites at lower elevations.

Lower on the slopes, lodgepole pine (Pinus contorta) becomes a major component of the forested areas. Understory vegetation varies. In some stands, mountain alder (Alnus crispa) forms dense thickets. In others, grouse-berry (Vaccinium scoparium) is a predominant understory species.

Vegetation on the ski runs is limited to low growing herbaceous species. Walker (1979) reported that in the steeply sloped area which extended from the Cliffhouse to the ski jump, ground cover was dominated by hairy wild rye (Elymus innovatus). There were few shrubs, but a high amount of herbs such as alpine fescue (Festuca ovina), June grass (Koeleria cristata)*, alpine hairgrass (Agrostis variabilis), yellow hedysarum (Hedysarum sulphurescens), yarrow (Achillea millefolium), timber oatgrass (Danthonia intermedia), wild strawberry (Fragaria virginiana), white dryad (Dryas octopetala). This vegetation community is stable and permanent, closely resembling plant communities which occur naturally in avalanche areas.

On the lower parts of the ski slopes where recontouring by machinery has resulted in soil loss, vegetation communities vary from a complete cover of native plants to a poor cover of agronomic (non-native) species. Creeping red fescue (Festuca rubra rubra) is the most common exotic species. In places, the Stoney Squaw ski slope for example, Walker (1979) noted an almost complete monoculture of this species.

Vegetation on the west and south-facing slopes of Stoney Squaw Mountain varies from lodgepole pine/Douglas fir associations on the dry south-facing aspects to dense lodgepole pine/spruce stands on the west-facing slopes. Past logging activities and burned stumps are particularly evident in this area, illustrating past human use of these slopes in the earlier decades of this century.

The lower, south-facing slopes of Mount Norquay and Stoney Squaw Mountain support vegetation reflecting the warm, dry conditions of that montane environment. On the bench of Mount Norquay just above the Vermilion Lakes, and on slopes traversed by the access road, conifers such as Douglas fir (Pseudotsuga menziesii), lodgepole pine (Pinus contorta), limber pine (P. flexilis), Rocky Mountain juniper (Juniperus scopulorum) and common juniper (J. communis) can be found. There are scattered individual Douglas fir trees of exceptional size. Vegetation displays evidence of heavy feeding and rutting activity by a variety of wildlife species.

In addition to the vegetation types dominated by coniferous species, a small stand of Populus tremuloides occurs at the base of the North American avalanche path just to the south of the existing North American ski run. The vegetation in the unskiied portion of the powerline right-of-way reflects the moist conditions of the gully, with thickets of willow and a lush herb mat.

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* Also known as K. macrantha

4.4.2 Significant Species and Associations

The Biophysical Land Classification (Holland and Coen, 1982) identified a number of plant species that were "significant" because they had a limited distribution, were at the limit of their geographic range, or were identified at few sites. Table 7 lists "significant" species in or near the study area that were identified in that report.

In addition to individual species of special significance, vegetation types dominated by Douglas fir occurring in the Mount Norquay area are special because they are of small areal extent within Banff National Park (Achuff, Pengelly and White, 1986). The Pseudotsuga menziesii/Elymus innovatus (Douglas fir/hairy wild rye) vegetation type occurs on dry, south-facing slopes in the Bow Valley, and is typical of the NY1 ecosite which occurs along the south-facing lower slopes of Mount Norquay and Stoney Squaw Mountain. It is not widespread in Banff National Park and is important wildlife habitat in this location. In many cases, these stands are 200-300 years old or more.

The montane ecoregion is very restricted in Banff National Park. Only 3% of the park occurs within this zone (Leeson and Harrison, 1988). The NY1, HD1 and PT1 ecosites on the lower slopes of Stoney Squaw Mountain and Mount Norquay are within this ecoregion and merit special environmental protection because of its limited extent.

Table 7

Significant Plant Species in the Mount Norquay Area (Holland and Coen, 1982)

SPECIES	LOCATION	REMARKS
Crepis intermedia	Cory Pass Trail	Dry grassland, montane
Draba reptans	Cory Pass Trail	Dry grassland, lower subalpine
Castilleja hispida	Mount Norquay	Pine forest, lower subalpine
Larix Lyallii	(Northern range boundary in Central Banff)	
Juniperus scopulorum	(Northern range boundary in Southern Banff)	
Pinus flexilis	(Northern range boundary in Northern Banff)	

4.4.3 Implications of Development

Development of the Mount Norquay Ski Area as proposed in the 1988 development plan has a number of important implications to vegetation, including forest clearing, impacts to significant vegetation associations, and removal of ground cover.

Development of new ski terrain on the Skyline Ridge will require some removal of trees in a mature lodgepole pine-dominated forest. This lower subalpine vegetation type is relatively common throughout the Rocky Mountains and although cutting is clearly an environmental cost, some clearing would not be highly significant. To ensure that new runs do not present an obviously unnatural landscape to national park visitors, planning of exact ski run design must carefully consider the visual impact to people in the Bow Valley. Straight line and horizontal cuts are particularly conspicuous. Because of the risk of windthrow, clearing plans should not depend on narrow strips or small groups of trees to minimize the visual obtrusiveness.

The willow/birch shrub vegetation community which occurs in the Bruno avalanche path provides a fall color display which is a pleasing visual contrast to the vast expanses of green of the predominantly coniferous vegetation of the Rockies. It also provides important and special habitat for a wide variety of ungulates, birds, insects, small mammals and bears. If the vegetation is removed, soil will be highly susceptible to erosion and extremes in water run-off will not be attenuated by the water-holding capacity of the vegetation. Development of the Bruno avalanche path for skiing will require the removal of this diverse and highly productive shrub meadow community - a significantly greater environmental impact than loss of a comparable area of the adjacent forest. Immediate revegetation of disturbed areas will reduce soil erosion although the other special resource values of the shrub communities will be lost.

The Douglas fir dominated forest in the montane ecosites on the south-facing slope of Mount Norquay is a significant vegetation type. Earlier development plans contained elements (e.g. lift construction to the base of the ski-out) which would have had significant impacts to this special park resource. However, implementation of Banff Lifts Limited's 1988 development plan will benefit this special resource as further development is not proposed for this site, and the existing use of this area for skiing will be limited to the lower Ski Out.

The presence of other site specific significant vegetation species in the study area is unknown. Therefore, a careful inventory of areas to be impacted is required when detailed plans are available to ensure that any rare or otherwise significant species are identified and protected as appropriate.

Significant road salt damage to Douglas fir trees along the Mount Norquay road was reported in 1983. In Banff National Park, the majority of salt-related tree deaths occurs on drought-prone south and west aspects - the Mount Norquay road, for example - and downhill from heavily salted roads. Vegetation damage is caused by airborne salt spray and salt-laden dust or road run-off and resulting soil contamination. The apparent trend of increasing mortality suggests either increasing levels of salt use, soil salt content in excess of natural buffering ability, an unfavourable climatic trend, or a combination of these and other factors. This impact can be controlled by reducing the amount of salt used, using less toxic salts (eg. calcium chloride instead of sodium chloride), using physical barriers to direct contaminated run-off away from high value trees, applying soil additives and washing foliage to remove air-borne salt (Westhaver, 1987).

Although potential impacts to vegetation from the implementation of the ski area plan are not so serious as to preclude further consideration of proposed development, it is important that vegetation be protected wherever possible. It is critical that adequate planning precede any disturbance so that as much ground cover as possible is retained to control erosion, that vegetation is quickly re-established, and wildlife habitat is safeguarded.

4.5 HYDROLOGY AND WATERSHED

4.5.1 Existing Conditions

The Mount Norquay Ski Area is contained wholly within the Bow River watershed. Much of the area drains into Forty Mile Creek, a major stream which extends 25 km from its headwaters east of the Sawback Range to its confluence with Echo Creek at Banff. The total drainage area is about 135 km^2 producing a mean summer discharge of 2.7 m^3/s. The average gradient is approximately 30 m/km. It is generally unaffected by human activity with the exception of the lower few kilometers that flow through Banff (Block and Gummer, 1979). Intermittent flashy streams drain through both Forty Mile and Bruno avalanche gullies directly into Forty Mile Creek. The Bruno

path's stream is particularly steep, cascading over a 10 m high waterfall in the lower section of the gully. A small intermittent stream drains the North American avalanche path into a wet meadow along the powerline right-of-way. This stream, together with run-off from the southern slopes of Mount Norquay and the meadows separating Stoney Squaw from Mount Norquay, does not drain through obvious surficial watercourses. Instead, drainage is subsurface, with discharge likely through springs along slopes just above the Trans-Canada Highway and in the Bow River Valley.

In the past, water supply was inadequate at Mount Norquay. To service the base lodge a well was drilled in 1950 and improved in 1952. It was one of 11 wells tried in the same area. This 10 m well (Stopford, 1978) supplied a 150,000 l reservoir which required supplementing during the winter by hauling water from Banff (about 4,550 l/day). Since installation of a low water use vacuum toilet system this water supply has been adequate for domestic requirements.

Water for the Cliffhouse is hauled by a tank on the gondola although a small diversion dam in a gully above the Cliff-house was constructed to provide a water source. The flow, however, is intermittent and is dry during much of the year.

An additional water source was required to provide water for snowmaking purposes. Therefore, a pipeline to supply the snowmaking system was installed down a gully near the Wishbone to the junction of the Forty Mile Creek and Forty Mile avalanche gully. Since its initial installation in 1984, the system has been gradually upgraded and improved. The pipe is partially buried near the top, but lies on or above the surface in its lower sections. Although the pipeline is visible, its impact to terrain and vegetation in the gully appears minimal -- far less than the well-worn wildlife trails it parallels for much of its length. The intake in the stream has required minimal disturbance to the bed of Forty Mile Creek. The water is pumped uphill and stored in an underground reservoir on the ski hill.

A water supply dam is located several hundred metres downstream from the snowmaking system water intake. Until recently, this reservoir supplied water to Banff townsite but as a result of persistent Giardia lamblia contamination, Banff now depends on a groundwater supply system instead. Although Forty Mile Creek is no longer the town's primary water source, it continues to serve as an emergency supply.

Water quality of Forty Mile Creek is generally quite high. Like most surface water it does not, however, meet acceptable drinking water standards because of high fecal coliform contamination (Water Quality Branch, 1975, 1976). It is reasonable to assume that the high population of wildlife in this watershed contributes significantly to the high coliform levels.

Monthly flow data for Forty Mile Creek is presented in Table 8 (Water Survey of Canada). Daily discharge data for the winter months is available from 1912/13 to 1919/20 and from 1945/46 to 1947/48.

4.5.2 Implications of Development

(a) Flow Regimes

When forest cover is removed, snow tends to accumulate on the ground and contribute more run-off than from forested areas. In addition, removing vegetation and smoothing topography in the Bruno avalanche gully will reduce the moderating affect on run-off that lush vegetation and circuitous stream channels provide. Run clearing will therefore increase the volume and speed of run-off. Snowmaking will also contribute some additional water. This will result in the potential for greater erosion and slope instability. To minimize the impact associated with ski terrain development in the shrubby meadows of Bruno avalanche path, as much shrubby vegetation as possible should be protected, rehabilitation of disturbed areas must be achieved quickly, and obstructions and convolutions in the stream channel should be retained. It may be necessary to incorporate energy dissipating techniques into the stream channels to reduce the flashy nature of the run-off if the stream energy threatens vegetation or soils within or downstream of the development area.

Water for the snowmaking system is currently pumped directly from Forty Mile Creek at the base of the Forty Mile Avalanche path to an underground storage reservoir on the ski hill. This reservoir evens out withdrawal demands on Forty Mile Creek, and therefore has the potential to reduce impacts to the aquatic environment of the creek downstream from the withdrawal point. Increased water storage capacity may be one method of reducing the impacts of stream withdrawal during low flow periods. Current water withdrawal volumes are unspecified; BLL estimates that up to 0.0377 m^3/sec would be required for the expanded snowmaking system. This amount is approximately 6.6% of recorded average January flows.

Table 8: Historical Monthly Flow Data, Forty Mile Creek
(Source: Water Resources Branch 1983)

MONTHLY MEAN DISCHARGES IN CUBIC METRES PER SECOND FOR THE PERIOD OF RECORD

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean*	Year
1912	---	---	---	---	---	---	---	4.10	3.06	1.95	1.29	0.743	---	1912
1913	0.817	0.712	0.583	1.05	2.68	10.4	4.68	3.40	2.77	1.85	1.24	0.924	4.27	1913
1914	0.652	0.635	0.793	0.825	3.45	8.68	5.69	2.22	1.50	1.81	1.23	0.683	3.88	1914
1915	0.765	0.585	0.440	0.942	2.17	5.20	6.42	3.26	2.05	1.72	1.28	0.527	3.47	1915
1916	0.547	0.602	0.536	0.837	1.66	8.66	8.87	3.53	2.34	1.53	0.884	0.587	4.42	1916
1917	0.432	0.464	0.368	0.379	2.06	7.02	5.81	2.25	1.38	1.25	0.800	0.769	3.29	1917
1918	0.516	0.380	0.364	0.502	2.08	5.98	3.72	2.12	1.43	1.22	0.788	0.528	2.75	1918
1919	0.464	0.446	0.334	0.669	3.38	5.06	2.83	2.54	1.35	0.734	0.507	0.304	2.64	1919
1920	0.221	0.305	0.339	---	---	---	---	---	---	---	---	---	---	1920
1945	---	---	---	---	---	---	---	---	---	1.10	0.653	0.644	---	1945
1946	0.511	0.443	0.448	0.627	---	7.18	3.94	2.31	2.68	1.94	1.19	0.827	---	1946
1947	0.653	0.489	0.451	0.781	5.62	7.54	4.22	1.93	1.70	1.43	1.09	0.877	3.73	1947
1948	0.715	0.631	0.502	0.602	---	---	---	---	---	---	---	---	---	1948
1972	---	---	---	---	3.16	10.3	6.40	3.65	2.17	1.63	---	---	4.53	1972
1973	---	---	---	---	3.72	8.72	5.95	2.37	1.41	0.950	---	---	3.84	1973
1974	---	---	---	---	1.37	8.99	5.18	2.62	1.49	1.13	---	---	3.44	1974
1975	---	---	---	---	1.11	3.46	3.34	2.18	1.57	1.06	---	---	2.12	1975
1976	---	---	---	---	3.88	5.29	6.10	3.75	2.39	1.31	---	---	3.79	1976
1977	---	---	---	---	2.59	4.93	3.07	2.56	1.87	1.29	---	---	2.71	1977
MEAN	0.572	0.517	0.469	0.721	2.78	7.16	5.08	2.80	1.95	1.41	0.996	0.674	3.49	MEAN

*for May to October (incl.) only.

LOCATION - Lat 51 12 24 N Drainage Area, 133 km^2
Long 115 35 05 W Natural Flow

Banff Lifts Limited proposes to continue to withdraw water from Forty Mile Creek at the existing location. A second intake at the base of the Bruno Avalanche gully is also proposed. The precipitous nature of the lower reach of the Bruno Avalanche path would seriously complicate installation and maintenance of the second pipeline. Therefore, it is recommended that water uptake be limited to the existing location.

Maintaining adequate discharge to support stream processes and fauna is an important factor in protecting aquatic habitats. Low winter stream flows in Forty Mile Creek, like many mountain streams, is a limiting factor in available habitat. For example, benthic fauna is limited by the area within the wetted perimeter of the stream. Both fish and birds depend on these benthic invertebrates as a food source. Fish are affected by factors such as stream depth and availability of riffle and resting areas. To ensure aquatic habitat is not impacted by water withdrawal, accurate estimates of Instream Flow Needs (IFN) for Forty Mile Creek are required to establish criteria specifying the amount of water which can be withdrawn for snowmaking purposes. There are many methods of determining IFN (Bietz et al, 1985) with the most accurate methods requiring complex and expensive data collection of specific streams.

The very limited amount of data available for Forty Mile Creek makes determination of IFN tenuous. However, a broad estimate of IFN can be made using the "Tennant Method", a system which relies upon stream guaging records. The Tennant Method provides a range of base flow conditions and relates it to aquatic habitat protection (Tennant, 1976) (Table 9).

Comparison of Table 8 and Table 9 reveals from the very limited data available, the <u>average</u> flows in Forty Mile Creek in December and January approach a "good" level of IFN.

However, as Table 10 illustrates, <u>daily</u> discharge during winter month falls below that required to maintain a "good" level of flow an average of 112 days per winter. During some winters, discharge falls below a level which results in "severe" base flow. (In the winter of 1919/20, daily discharge was less than the "severe" level on 91 days.)

To maintain a "good" level of IFN, water withdrawal for snowmaking must be restricted to periods when discharge in Forty Mile Creek exceeds $0.698 m^3/s$. Based on available data, water withdrawal would be curtailed an average of 112 days per year (See Table 10). It is apparent that if a "good" theoretically derived IFN standard is a requirement, snowmaking would be severely curtailed.

Table 9

Recommended Base Flow Regimes (Tennant, 1976) Applied to Forty Mile Creek

Narrative Description of Flows	Recommended Base Flow Regime (Oct. - Mar.)	Winter IFN* Forty Mile Creek m^3/s
Flush/Maximum	200%	6.98
Optimum	60 - 100%	2.09 - 3.49
Outstanding	40%	1.396
Excellent	30%	1.047
Good	20%	0.698
Fair or Degrading	10%	0.349
Poor or Minimum	10%	0.349
Severe	0 - 10%	0 - 0.349

* Instream Flow Needs required to maintain specified levels of habitat protection to Forty Mile Creek, based on a mean annual flow of 3.49 m^3/s.

The analysis presented above is a theoretical assessment based on very limited data. For example, it does not take into account the impacts which occurred when Banff town was supplied by water from Forty Mile Creek. Therefore, prior to the development of new and upgraded lifts and ski terrain dependent on an expanded snowmaking system, information about water volumes and withdrawal schedules is required to determine if the system could be operated within guidelines for environmental protection. To more accurately predict impacts, further investigation into actual winter flows in Forty Mile Creek and aquatic habitat protection is required. It should compare the expected impacts of snowmaking water withdrawal with the impacts which would have occurred when Banff town used water from Forty Mile Creek.

Table 10: Number of Days When Forty Mile Creek Discharge Fell Below Specified Instream Flow Needs Levels* (IFN) (Data Source: Water Survey of Canada)

Time Period	Days with Data Available	Days With Flows Below "Good" IFN
Nov. 1912	30	6
Dec. 1912	31	21
Jan. 1913	31	7
Feb. 1913	28	12
Mar. 1913	31	31
Apr. 1913	30	9
Jan. 1914	31	11
Feb. 1914	28	18
Mar. 1914	31	4
Apr. 1914	30	5
Nov. 1914	30	2
Dec. 1914	31	17
Jan. 1915	31	11
Feb. 1915	28	27
Mar. 1915	31	30
Apr. 1915	31	14
Dec. 1915	31	29
Jan. 1916	31	27
Feb. 1916	29	21
Mar. 1916	31	30
Dec. 1916	31	23
Jan. 1917	31	31
Feb. 1917	28	28
Mar. 1917	31	31
Apr. 1917	30	30
May 1917	31	8

Time Period	Days with Data Available	Days with Flows Below "Good" IFN
Dec. 1917	31	3
Jan. 1918	31	24
Feb. 1918	28	28
Mar. 1918	31	31
Apr. 1918	30	29
Dec. 1918	31	30
Jan. 1919	31	31
Feb. 1919	28	28
Mar. 1919	31	31
Apr. 1919	30	18
Oct. 1919	31	13
Nov. 1919	30	30
Dec. 1919	31	31
Jan. 1920	31	31
Feb. 1920	29	29
Mar. 1920	31	31
Oct. 1945	31	1
Nov. 1945	30	20
Dec. 1945	31	20
Jan. 1946	31	31
Feb. 1946	28	28
Mar. 1946	31	31
Apr. 1946	30	22
Dec. 1946	31	3
Jan. 1947	31	16
Feb. 1947	28	28
Mar. 1947	31	31
Apr. 1947	30	17
Jan. 1948	31	10
Feb. 1948	29	21
Mar. 1948	31	30
Apr. 1948	30	20

* Instream Flow Needs (IFN) as described in Tennant (1976). The recommended base flow required to maintain a "good" level of aquatic habitat protection is 40% of the annual mean flow. Therefore, assuming mean annual flow in Forty Mile Creek is 3.49 m^3/s (Water Survey of Canada data), 0.698 m^3/s is required to achieve "good" base flow.

Measuring stream discharge under ice conditions is difficult and there will likely be operational problems with ensuring that water withdrawal is curtailed when flows are low. Approval for further water withdrawal must require that techniques to accurately measure flow be identified and that controls on water withdrawal will be effective.

(b) Water Quality

Proceeding with expansion and redevelopment of the Mount Norquay Ski Area as proposed in the development plan would have an effect on the water quality of surface waters draining the area. The major deterioration in water quality would be due to increases in suspended sediment (Anderson et al, 1976). Wherever terrain is disturbed or vegetation removed, soils become susceptible to erosion, especially on steep slopes. Terrain recontouring, run preparation, snow-making installation and building construction will significantly increase short term erosion, and contribute to high suspended sediment in receiving waters. To mitigate this impact, erosion can be reduced by minimizing terrain disturbance, retention of as much vegetation as possible, extensive use of water bars, and immediate site rehabilitation.

Terrain recontouring and removal of vegetation which accelerates run-off speed in the Bruno avalanche path may have long term effects on water quality as the flashier nature of the stream will result in higher suspended sediment levels. Currently, much of the debris entrained in the run-off is captured by vegetation and rough topography. The smoother slope created by ski run development will not be as effective in dissipating stream energy, so more soil and debris can be expected in watershed discharge.

Sewage disposal is currently a problem at the Mount Norquay Ski Area and must be upgraded to adequately treat existing volumes. Shock loading, relatively strong sewage, and cold temperatures experienced during winter present difficulties for sewage treatment at ski areas (Gosz, 1982). Sewage treatment at Mount Norquay must be improved to meet current requirements and will certainly require upgrading to deal with increased skier numbers.

4.6 FISH AND WILDLIFE

4.6.1 Existing Conditions

(a) Invertebrates

Little is known about invertebrate fauna in the study area. Changes in vegetation, hydrology and snowmelt patterns will no doubt influence existing populations. However, with the exception of aquatic populations that could be impacted by stream flow changes in Forty Mile Creek, these changes are not expected to be significant.

(b) Fish

Forty Mile Creek downstream from the ski area and below the existing dam is a productive sport fishery. It was first stocked in 1915 with cutthroat trout (Salmo clarkii). Since then, brook trout (Salvelinus fontinalis) and rainbow trout (Salmo gairdneri) have also been introduced. The stream is now primarily a brook trout fishery. It is likely that bull trout (Salvelinus malma), mountain whitefish (Prosopium williamsoni) and a variety of minnows and shiners also occur in this stream as they are native fish which frequent similar waters throughout the Rocky Mountains.

(c) Herptiles

Generally, herptiles are not common in Banff National Park because of the relatively harsh climatic conditions. The exception is the western toad (Bufo boreas) which is the most widespread and frequently encountered amphibian in Banff. It occurs throughout the study area. Both the wood frog (Rana sylvatica) and spotted frog (Rana pretiosa) also probably occur in the study area along Forty Mile Creek although they are uncommon in the park. The wandering garter snake (Thamnophis elegans vagrans) is the only reptile which has been reported (B. Leeson, pers. comm.; J. Rouse, pers. comm.) at Mount Norquay.

(d) Avifauna

The study area contains a variety of habitats which support a number of different breeding bird communities. Holroyd and Van Tighem (1983) describes the breeding bird communities found in Banff and Jasper national parks. A number of these occurs in the study area.

The Douglas fir forest (Bird Community 3 in Holroyd and Van Tighem (1983)) is very restricted in areal extent in the two parks, and has been substantially impacted by the development of transportation routes. This community type is found on the south-facing slopes of Stoney Squaw Mountain and Mount Norquay, including portions of the existing North American run and ski area access road. Species found here are :

dark-eyed junco
yellow-rumped warbler
American robin
mountain chickadee
white-winged crossbill
western tanager
Bohemian waxwing
red-eyed vireo
pine siskin
chipping sparrow
Swainson's thrush
warbling vireo
brown-headed cowbird
common flicker
solitary vireo
rough-winged swallow

A number of other bird communities occur in and adjacent to the ski area, but none are as restricted in extent in the parks as the community of the Douglas fir forest. Species in other bird communities in the study area include :

pine siskin
dark-eyed junco
American robin
brown creeper
red crossbill
gray jay
boreal chickadee
golden-crowned kinglet
pine grosbeak
boreal owl
blue grouse
gray-crowned rosy finch
common flicker
winter wren
rufous hummingbird
calliope hummingbird
Clark's nutcracker
red-breasted nuthatch
northern three-toed woodpecker
chipping sparrow
fox sparrow
golden-crowned sparrow
Brewer's sparrow
vesper sparrow
varied thrush
hermit thrush
Swainson's thrush
yellow-rumped warbler
Wilson's warbler
orange-crowned warbler
Townsend's warbler
warbling vireo
solitary vireo
alder flycatcher
western flycatcher
olive-sided flycatcher

There are other species not included in these communities which are of note. Bald eagles frequently nest at Vermilion Lakes at the base of Mount Norquay, and are commonly observed over the study area flying along the Forty Mile Creek drainage. Although they hunt mostly in wetlands and along

the shores of water bodies, they also frequent open and semi-open habitats where they scavenge dead ungulates. Golden eagles, too, are likely to find suitable hunting habitat on the open and semi-open meadows of the study area. They feed largely on rodents and are opportunistic feeders on carrion. As they nest on cliffs, especially south-facing ones, the cliffs of Mount Norquay may be attractive as nesting habitat for these birds. Habitat for American dippers occurs along Forty Mile Creek. The open grassy ski runs are ideal locations to view mountain bluebirds.

(e) Small Mammals

Associations of small mammals and their relative abundance are a reflection of the microhabitats available to them. They are an integral component of the diet of many raptors and mammalian carnivores. The following species are typical residents of the types of habitats found in the study area :

masked shrew (Sorex cinereus)
dusky shrew (S. monticolous)
water shrew (S. palustris)
varying hare (Lepus americanus)
least chipmunk (Eutamias minimus)
Columbian ground squirrel (Spermophilus columbianus)
golden-mantled ground squirrel (S. lateralis)
red squirrel (Tamiasciurus hudsonicus)
deer mouse (Peromyscus maniculatus)
bushy-tailed wood rat (Neotoma cinerea)
Gapper's red-backed vole (Clethrionomys gapperi)
meadow vole (Microtus pennsylvannicus)
long-tailed vole (M. longicaudis)
western jumping mouse (Zapus princeps)
American porcupine (Erethizon dorsatum)
American marten (Martes americana)
short-tailed weasel (Mustela erminea)
least weasel (M. nivalis)
big brown bat (Eptesicus fuscus)
little brown bat (Myotis lucifugus)
northern flying squirrel (Glaucomys sabrinus)

(f) Large Predators

The most common large predator in the study area is the coyote (Canis latrans). Small mammals are important prey. When available, carrion and garbage are eaten. During winter ungulates appear to be important, with mule deer and bighorn sheep being the major prey species. In the spring, newly-born elk and deer are preyed upon (Holroyd and Van Tighem, 1983).

Timber wolves (Canis lupus) have become re-established in Banff National Park after near extirpation by control programs which ended in 1959. The Forty Mile Creek watershed, including Mount Norquay, provides important habitat for wolves and their prey.

Both black bears (Ursus americanus) and grizzly bears* (U.arctos horribilus) occur in and near the study area. Wet, moist meadows, lush stands of buffalo-berry (Shepherdia canadensis) and streamside mats of horsetail (Equisetum sp.) provide attractive foraging habitat. The dense populations of ungulates in the area are attractive prey (especially calves in spring) and a carrion food source. Black bear denning has been noted in the area. Olson (1984) reports that in February 1968 Warden Kutzer recorded the birth of two cubs near the Norquay road. The mother had denned in a culvert under the road.

Cougar (Felis concolor) are rarely sighted in Banff National Park. They are, however, associated with habitats like those found in the study area - mixed forest, closed lodgepole pine forest, Douglas fir forest, and Engelmann spruce-subalpine fir forest. Distribution of prey species strongly influences cougar habitat use. Deer and elk are important prey species in Banff National Park (Holroyd and Van Tighem, 1983), and Olson (1984) notes an instance of cougar predation on sheep in the study area.

Canada lynx (Lynx canadensis) are relatively scarce in Banff, but occur coincidentally with varying hares, their primary prey species. In Banff they also prey on sheep and mule deer. Their favored habitats are in lodgepole pine-spruce forests, shrub meadows, and Engelmann spruce-subalpine fir forests - all habitats found in and near the study area (Holroyd and Van Tighem, 1983).

(g) Ungulates

The study area is important habitat for a number of ungulate species. The area has a diversity of habitats resulting from the proximity of avalanche chutes and closed forest, rocky cliffs, open grassy meadows, south-facing windswept slopes and water. It provides for the shelter, security, travel routes and food requirements of bighorn sheep (Ovis canadenis), elk (Cervus elaphus), mule deer (Odocoileus hemionus), moose (Alces alces) and mountain goat (Oreamnos americanus). The importance of the study area to ungulates

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* During a site visit on September 12, 1982, the author disturbed a grizzly sow and cub in the Bruno avalanche path during a site visit where the bears had apparently been feeding on Shepherdia berries.

is amplified because of the limitations of the surrounding area (e.g. transportation corridors and visitor facilities). Mount Norquay and Stoney Squaw Mountain are used intensively by ungulates during all seasons of the year. The mild climatic conditions experienced by the lower elevation, south-facing slopes make these sites particularly significant as winter wildlife habitat.

Mule Deer

Mule deer range throughout the study area, but the south-facing slopes of Mount Norquay and Stoney Squaw Mountain show evidence of especially heavy use by this species, consistent with the biophysical inventory evaluation (Holroyd and Van Tighem, 1983) (Table 11, Figure 10). The south-facing slopes of Stoney Squaw Mountain and Mount Norquay provide very important winter range because of low snow depths.

Recent investigation (Olson, 1984) confirms that the area is heavily used by mule deer. Of 17 transects established in the Banff area to measure wildlife habitat importance, the transect located in an MY1 ecosite on the south-facing slope of Mount Norquay was the second most heavily used location sampled. Both random observations and systematic road censuses also indicated very high use by mule deer, especially during the spring (R. Kunelius, pers. comm.). The Norquay-Cascade area "is used by mule deer for bedding, feeding, seasonal and inter-unit migration, and possibly for breeding/rutting and as a fawning area" (Olson, 1984).

Bighorn Sheep

According to the biophysical inventory (Holroyd and Van Tighem, 1983), very important winter habitat for sheep (Figure 11) corresponds with that of mule deer in the study area. Sheep use the south-facing slopes of Mount Norquay and Stoney Squaw Mountain extensively during all times of the year, with concentrations of use occurring during April when sheep are attracted to early green-up of these slopes. Sites especially attractive to sheep appear to be a small clearing near the top of the Mount Norquay access road (the "Greenspot") and slopes above the First and Second Vermilion Lakes. Recent radio tracking of sheep (R. Kunelius, pers. comm.) indicates that these areas provide habitat for sheep which congregate from far distant locations in Banff National Park, including Elk Lake Summit, Stoney Creek and up the Cascade. Mount Norquay is an important part of the range of the Cascade-Vermilion sheep herd, which numbers at least 62 animals. The north slopes of Mount Norquay are a traditional lambing ground for this herd (Kellas and Low, 1987).

Table 11

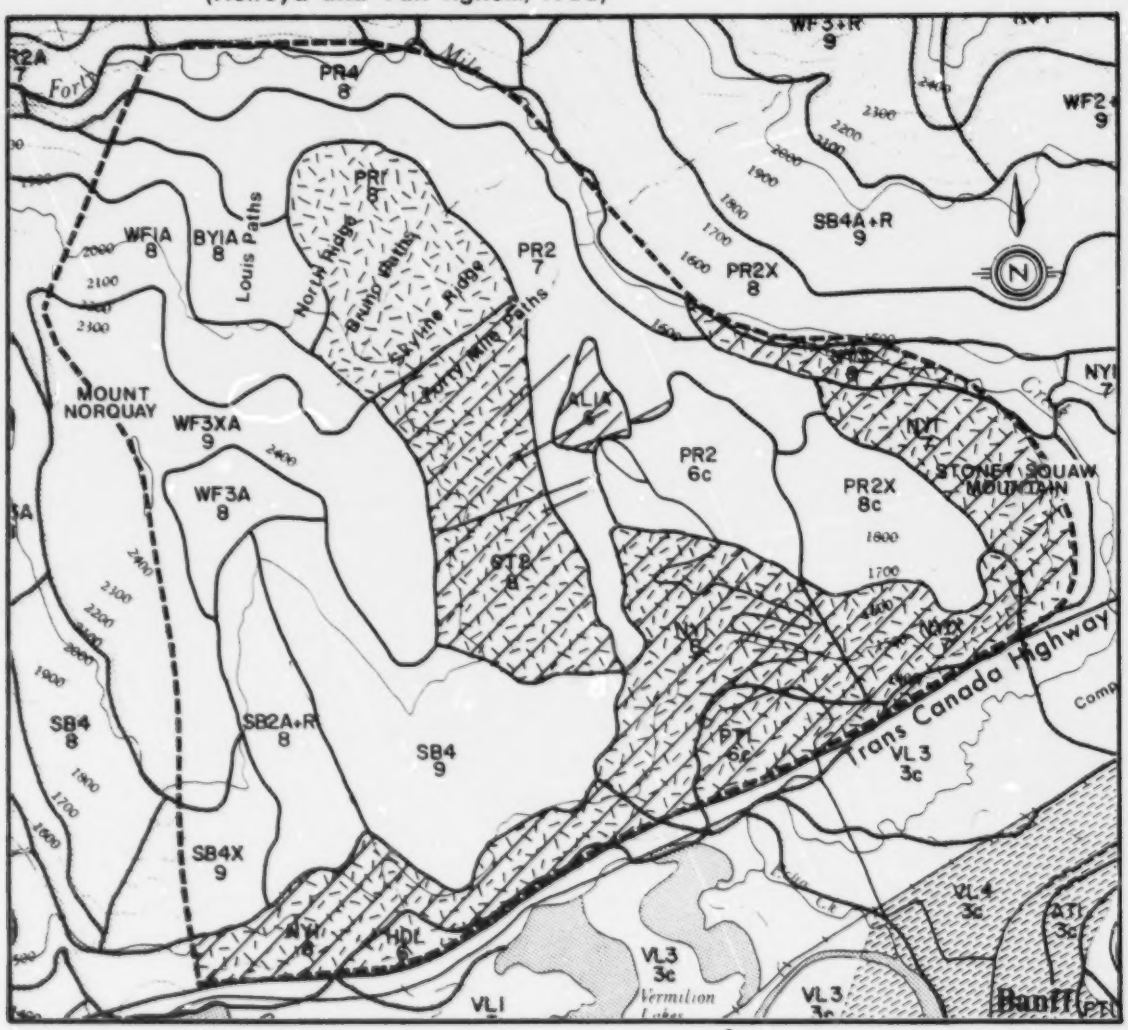
Ecosite Importance to Ungulates (Holroyd and Van Tighem, 1983)

ECOSITE	Deer		Moose		Elk		Goat		Sheep	
	W	S	W	S	W	S	W	S	W	S
AL1	M	H	M	L	M	H	L	-	-	-
GT2	H	H	L	-	V	V	H	L	-	H
HD1	H	M	L	L	H	H	-	-	-	-
NY1	V	V	M	-	V	H	-	-	V	-
PR2	M	L	M	L	M	H	L	L	M	M
PT1	H	H	M	L	H	H	L	-	M	M
SB2	L	-	M	M	M	M	M	-	L	M
SB4	M	-	L	-	M	L	H	M	H	M
WF3	L	-	L	M	L	L	V	H	H	H

Legend
W = Winter (mid-July to mid-April)
S = Summer (mid-April to mid-July)
- = Zero
L = Low
M = Medium
H = High
V = Very High

Figure 10: Mule Deer Habitat Potential

(Holroyd and Van Tighem, 1983)



high or very high winter habitat potential

high or very high summer habitat potential

Observations (Figure 12) show that individual animals use habitat on both sides of the ski area and heavy trails indicate that they travel across the south-facing slopes of Mount Norquay to access the slopes above Vermilion Lakes and the Greenspot. Fencing of the Trans-Canada Highway requires sheep to travel across the slopes of Mount Norquay to access wildlife underpasses as they cannot otherwise cross the Trans-Canada Highway. Although highway fencing has made access to important habitats more difficult, it has reduced sheep mortality caused by vehicle collision. Previous to fencing of the Trans Canada Highway, more than 9 sheep were killed each year, largely in April and May (Kellas and Low, 1987). Ironically, although Trans Canada Highway fencing has reduced sheep mortality due to vehicle collisions, predators are using the fence to trap sheep, resulting in a number of sheep being killed by coyotes.

In addition to making movement through this area more difficult for sheep, widening of the Trans-Canada Highway above Vermilion Lakes has destroyed some of the best feeding and resting habitat for sheep in the Bow Valley, increasing the relative importance of remaining habitat on Mount Norquay and Stoney Squaw Mountain.

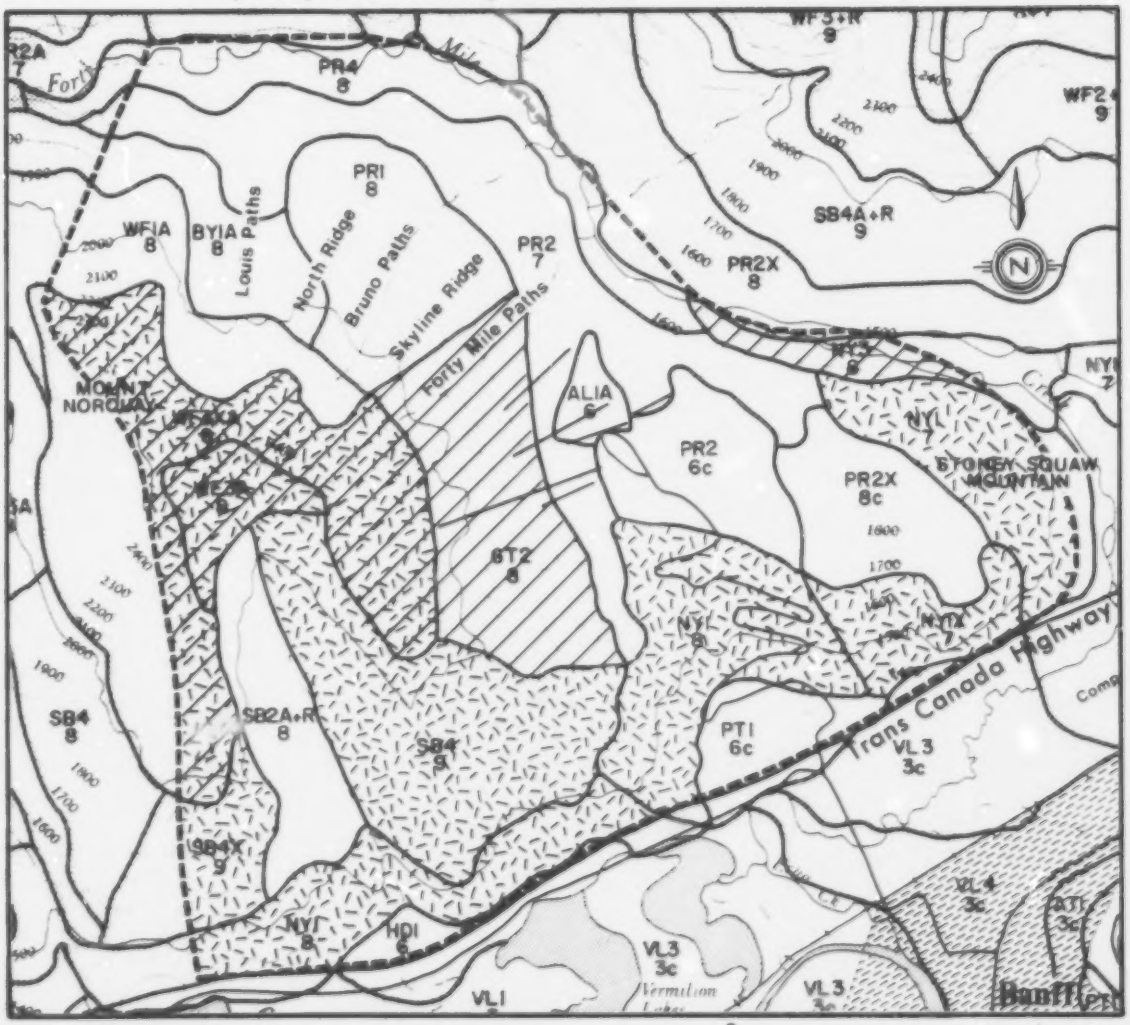
A heavily used sheep bedding area exists on south-facing cliff bands between the North American avalanche path and the North American run. Rutting activity has also been observed on the slopes within the ski area and along the Norquay access road (Olson, 1984; Kellas and Low, 1987).

Elk

The biophysical inventory (Holroyd and Van Tighem, 1983) predicts that the area is highly important to elk during both summer and winter (Figure 13). Olson (1984) confirmed this during pellet transect surveys in the Banff area. Peak use of the area by elk appears to occur in late April and May when the spring green-up occurs, and during the fall rutting season. Elk bedding areas along the base of Cascade Mountain, slopes on Stoney Squaw Mountain and Mount Norquay were considered as critical elk habitat. The ski runs and slide paths are of major importance for rutting, second only to the golf course (Olson, 1984). During site visits in the early and mid-summer (1984-1987) seasons, elk cows with calves were consistently observed resting and feeding in avalanche gullies north of the developed ski area - Forty Mile, Bruno and Louis avalanche paths - and in the upper parts of the Wishbone run where shrubs had become established. The Norquay Ski Area is one of Banff's best locations to listen for bugling bull elk during the fall rut.

Figure 11: Bighorn Sheep Habitat Potential

(Holroyd and Van Tighem, 1983)



high or very high winter habitat potential

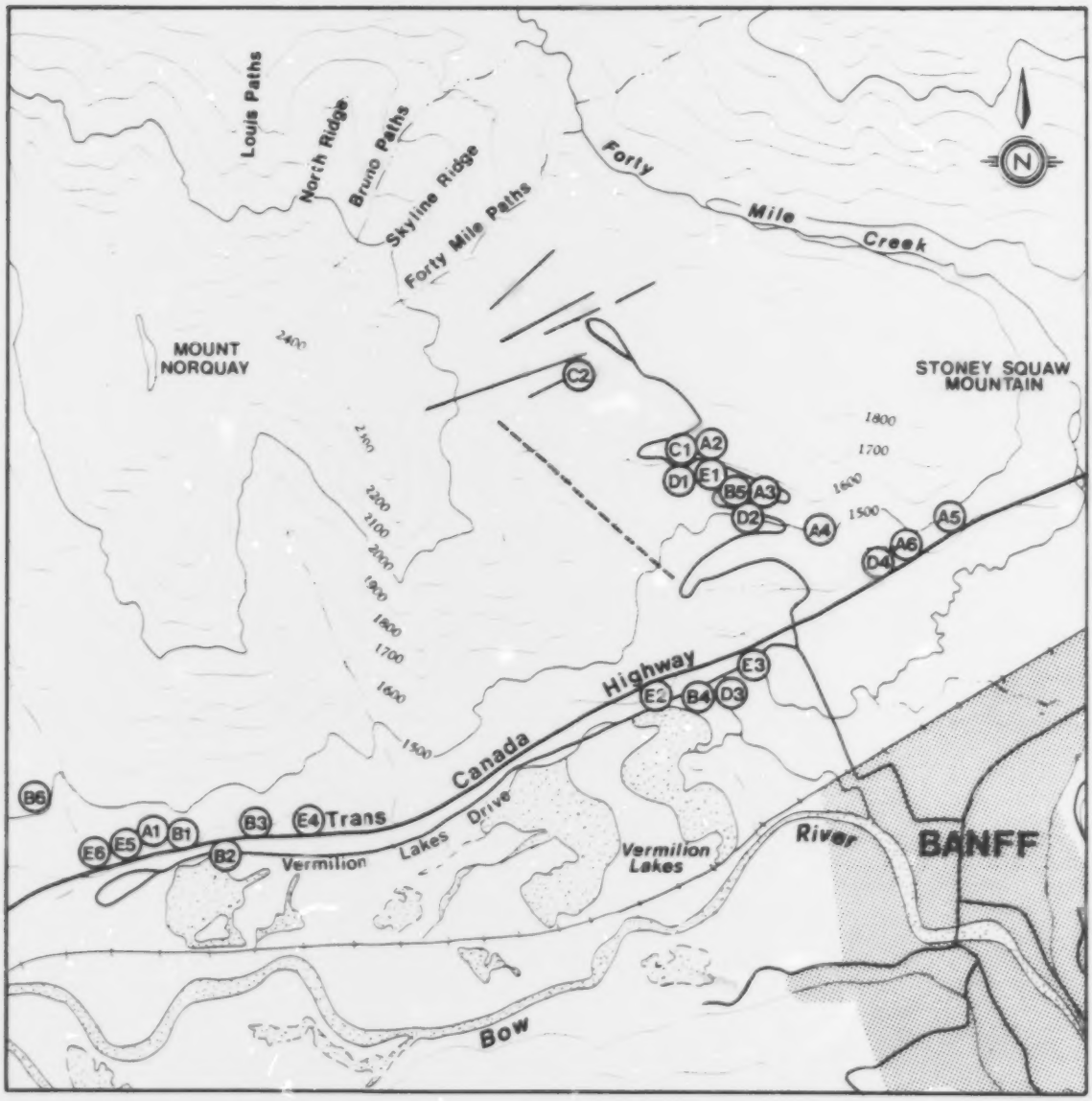
high or very high summer habitat potential

Figure 12: Bighorn Sheep, Radio-Tracking and Visual Observations (R. Kunelius, Banff National Park Warden Service)

	Map Key	Date	Remarks
Sheep A: (Ram)	A1	85/12/19	- collared above TCH, west end of Third Vermilion Lake
	A2	85/12/30	- Norquay, Green Spot
	A3	86/01/02	- Norquay, below Green Spot
		86/02/05	- as above
	A4	86/01/13	- east end of Green Spot, low
	A5	86/01/14	- highway, east side of Stoney Squaw rock cut
	A6	86/01/26	- west side of Stoney Squaw rock cut, in north ditch
		86/01/29	- Stoney Squaw rock cut with 3 other rams
		86/01/30	- as above
		86/01/31	- as above
		86/02/01	- as above
		86/02/06	- southeast side, Stoney Squaw
		86/03/18	- Norquay, somewhere below Green Spot
Sheep B: (Ewe)	B1	85/12/19	- collared above TCH, west end of Third Vermilion Lake
	B2	85/12/28	- below TCH, east end of Third Vermilion Lake
		85/12/30	- above TCH, Third Vermilion Lake
	B3	86/01/02	- east end of Third Vermilion Lake, both sides above TCH
		86/01/05	- near Second Vermilion Lake, above TCH
		86/01/13	- above TCH, vicinity First Vermilion Lake
	B4	86/01/14	- rock cut, First Vermilion Lake, below road
	B5	86/01/29	- Norquay road, below Green Spot
		86/03/06	- Mt. Edith Trail
		86/03/07	- as above
	B6	86/03/18	- south slopes, Mt. Edith
		86/04/13	- as above, with 23 others
Sheep C: (Ram)	C1	85/12/31	- collared, Green Spot
		86/01/02	- Norquay, near lodge somewhere
	C2	86/01/05	- Norquay lodge, somewhere indefinite
		86/01/13	- signal straight up valley from Third Parking Lot
	C3	86/02/02	- knoll northwest of Stoney Cabin (16 km north of capture site
Sheep D: (Ram)	D1	85/12/23	- collared, Norquay Green Spot
		85/12/27	- Norquay Green Spot, high
		85/12/30	- Norquay Green Spot, low
		86/01/02	- Norquay Green Spot
	D2	86/01/05	- Norquay Green Spot, middle
		86/01/13	- above TCH, First Vermilion Lake
	D3	86/01/14	- First Vermilion rock cut below TCH
	D4	86/01/26	- west side of Stoney Squaw rock cut in ditch
		86/01/29	- Stoney Squaw rock cut with 3 others
		86/01/30	- as above
		86/01/31	- as above
		86/02/01	- as above
		86/02/22	- Norquay Green Spot, low
		86/03/01	- as above
		86/03/04	- as above
		86/03/05	- as above
		86/03/06	- as above
		86/03/08	- as above
		86/03/18	- Norquay, below Green Spot
Sheep E: (Ewe)	E1	85/12/27	- collared, Green Spot
		85/12/30	- Norquay
		86/01/02	- Second Vermilion Lake, indefinite
	E2	86/01/05	- Second Vermilion Lake, below TCH
		86/01/13	- east of Second Vermilion Lake, below TCH
	E3	86/01/14	- rock cut, First Vermilion Lake, above TCH
		86/01/15	- as above
	E4	86/01/16	- rock cut, Third Vermilion Lake, above TCH
	E5	86/01/16	- Edith Trail
		86/01/25	- TCH, km 19.2
		86/03/06	- NG 965712
		86/03/07	- NG 964713
		86/03/18	- Norquay, somewhere below Green Spot
		86/04/06	- north side of road, 0.5 km west of Third Vermilion Lake (with 9 others)
		86/04/13	- second loop up Norquay

Figure 12: Bighorn Sheep, Radio-tracking and Visual Observations

(R. Kunelius, Banff National Park Warden Service)



Contour Interval – 100 metres
(approximate due to conversion)

0 1 Miles

0 1 Kilometres

---- proposed North American Lift

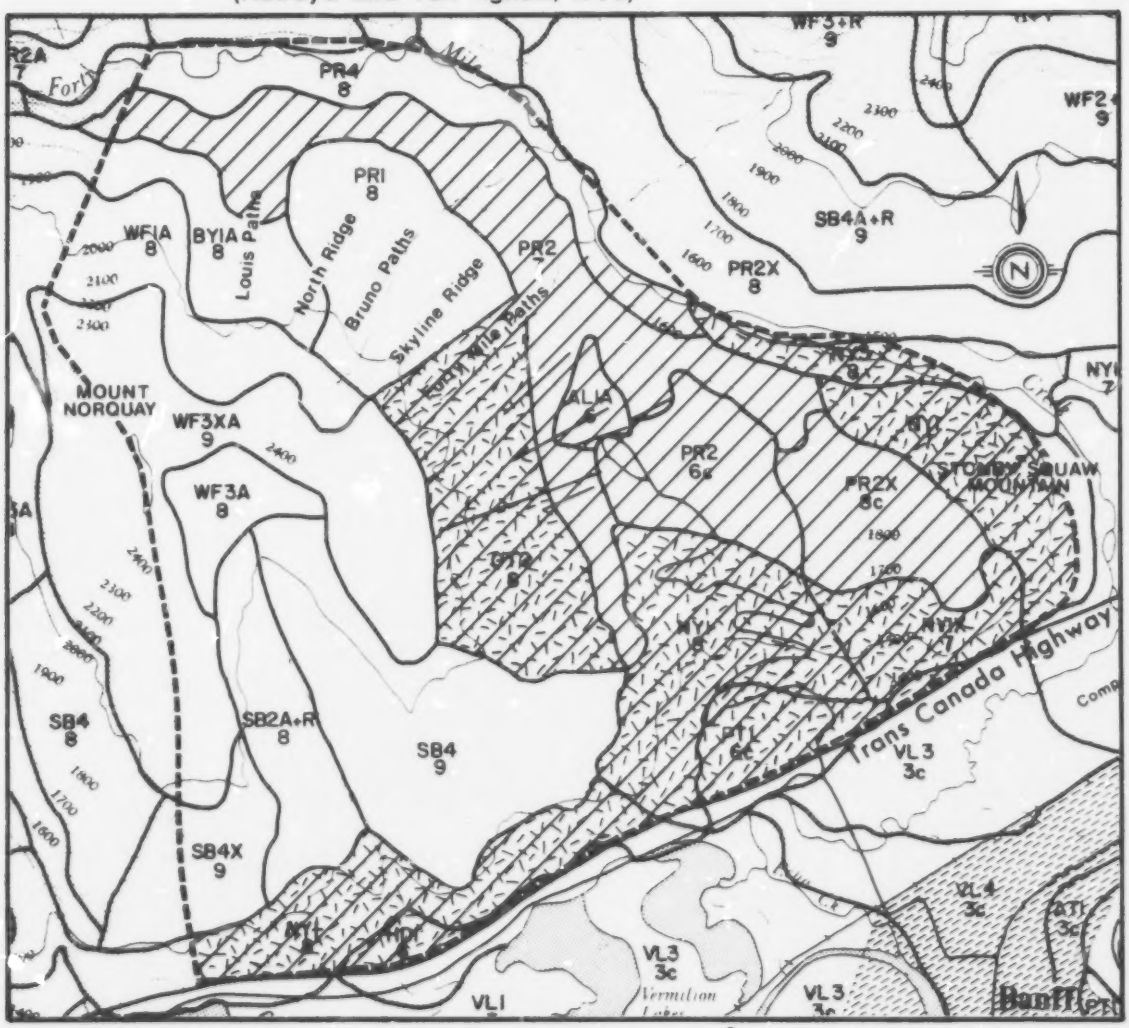
The study area also serves as an important travel route for elk, both for seasonal migration along the Bow Valley, and between the Bow Valley and Forty Mile Creek drainage; and for general movement. Olson (1984) reported that 37 trails were encountered in two transects on the south-facing slopes of Mount Norquay and Stoney Squaw Mountain. Of these, 31 were oriented in an east/west direction, indicating significant wildlife movement across the slopes, approximately parallel to the Trans-Canada Highway. In the twinning of the Trans-Canada Highway the importance of this movement pattern was recognized and a wildlife trail was constructed across the face of Stoney Squaw Mountain. This is an attempt to mitigate the impacts of highway fencing which prevents animals on the north side of the highway from using the Forty Mile Creek swamp as a route around the Stoney Squaw cliffs.

Observations of radio-collared elk in the Bow Valley during the first three months of 1986 supported the belief that the south-facing slopes of Mount Norquay are important for wildlife movement. In a research program aimed at determining the acceptability of highway underpasses to elk, "Preliminary results of radio-collared elk indicate no movement of elk through underpasses in Phase 1 [of the Trans-Canada Highway twinning program - East Gate to Banff Townsite], yet fairly long movements are being observed in easterly and westerly directions, especially along the Bow River. Therefore, east/west corridors along the Bow Valley such as Norquay are important" (LeBlanc, unpubl. data). Figures 14 and 15 illustrate the movements of two animals tracked through radio-collar locations.

Further investigation in 1986 indicated that elk used highway underpasses to a limited extent. The Bow Valley from the Cascade Powerhouse (just east of Banff Townsite) to the Sunshine road turn off "is a pivotal area for elk migration routes connecting with the lower Bow River valley. Documented migration routes connecting with the lower Bow River valley include : . . . Norquay to Elk Pass" (Woods, 1987). Trans-Canada Highway collision data (pre-fencing) also indicates the importance of the lower slopes of Mount Norquay as an animal movement, feeding and resting area. The highest ungulate collision mortality of any 2 km section of highway in Banff National Park from May 1985 to December 1986 (inclusive) was on the highway immediately adjacent to the Mount Norquay study area. Since each ungulate kill represents an unsuccessful attempt to cross the highway in an area immediately adjacent to the study area, this data supports the conclusion that the lower Norquay slopes are very heavily used by elk (Woods, 1987b).

Figure 13: Elk Habitat Potential

(Holroyd and Van Tighem, 1983)



high or very high winter habitat potential

high or very high summer habitat potential

Figure 14: Elk Radio-Tracking Observations, "Norquay's" Movements (R. LeBlanc and J. Woods, pers. comm.)

Observation Notes:

Name: Norquay
Sex/Age: Yearling cow

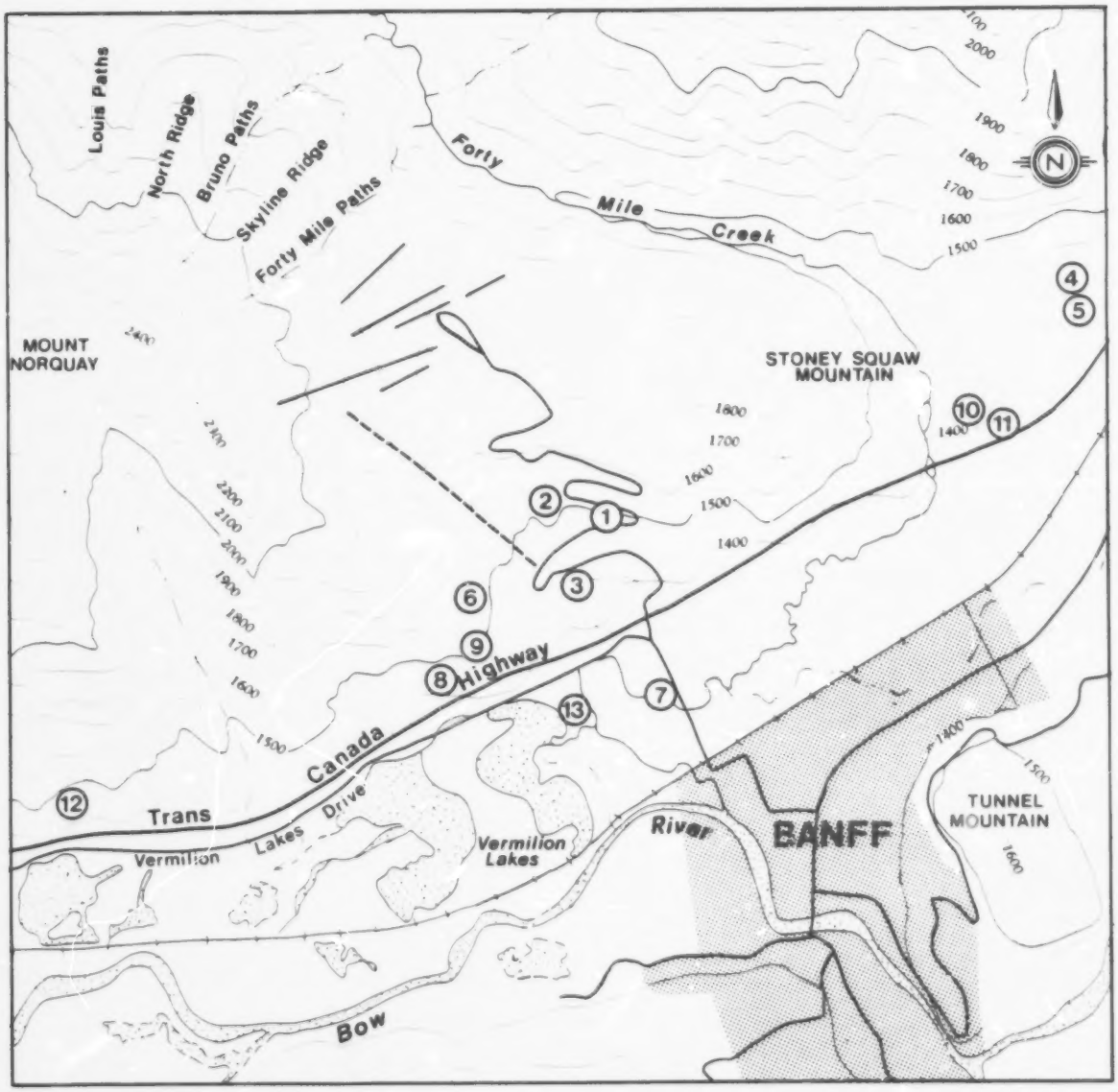
Radio-collared January 24/86 on the Norquay ski road.

She has spent most of the winter on the lower slopes (south-facing) of Mount Norquay. She has ranged east as far as the airport and west to Mount Cory. Radio locations indicate she travels along the lower slopes of Mount Norquay.

MAP KEY	DATE	REMARKS
1	86/01/24	- collared, Mount Norquay ski road
2	86/01/27	
3	86/02/03	- Norquay
4	86/02/14	- airport
5	86/02/19	- airfield
6	86/02/25	- Norquay
7	86/02/26	- below Timberline Hotel, south side of TCH
8	86/03/05	- lower Norquay, near Timberline
9	86/03/10	- with 4 - 6 elk
10	86/03/19	- with 14 cows, 3 spike bulls and 1 calf
11	86/03/26	- with at least 10 other elk
12	86/03/31	- Third Vermilion Lake, north side TCH
13	86/04/08	- First Vermilion Lake, south side TCH

Figure 14: Elk Radio-tracking Observations, Norquay's Movements

(R. LeBlanc and J. Woods, pers. comm.)



Contour Interval = 100 metres
(approximate due to conversion)

0 1 Miles

0 1 Kilometres

---- proposed North American Lift

Figure 15: Elk Radio-Tracking Observations, "Rocky's" Movements (R. LeBlanc and J. Woods, pers. comm.)

Observation Notes

Name: Rocky
Sex/Age: young bull (est. 3 - 4 years old)

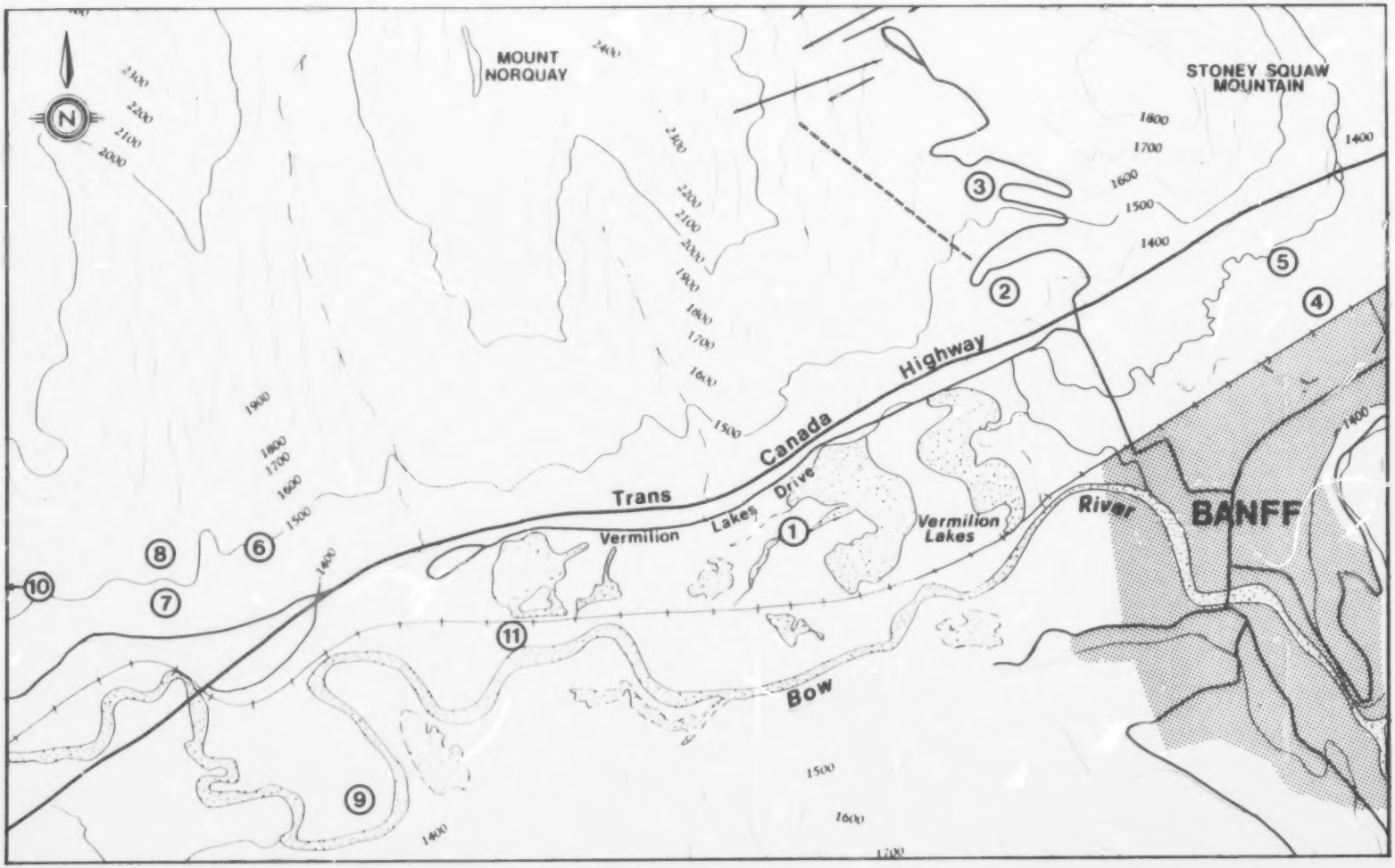
Radio-collared on the west end of the Second Vermilion Lake, on February 09, 1986. Antlers: 4 points by 3 points. When collared, he was with about 75 cows, calves and spike bulls.

This bull stayed fairly close to the Vermilion bunch which numbers about 150 elk, however, 4 other elk are collared from this herd and Rocky is the only one which has been located on Mount Norquay.

MAP KEY	DATE	REMARKS
1	86/02/09	- collared west end of Vermilion Lake, with about 75 other elk
2	86/02/10	- Norquay
3	86/02/11	- Norquay
4	86/02/20	- townsite, CPR line wye
5	86/02/26	- south and east of Norquay overpass
6	86/03/05	- Mt. Edith lower slopes
7	86/03/11	- north of 1A and intersection with Mt. Edith
8	86/03/17	- north of 1A and intersection with Mt. Edith
9	86/03/25	- south side of TCH by Bow River
10	86/03/31	- Cory Mountain, north side of 1A
11	86/04/08	- Bow River, south of Third Vermilion Lake

Figure 15: Elk Radio-tracking Observations, Rocky's Movements

(R. LeBlanc and J. Woods, pers. comm.)



Moose

Moose populations are relatively low in Banff National Park, and the Mount Norquay area is not characterized by very important moose habitat (Holroyd and Van Tighem, 1983) (Figure 16). Nevertheless, individual animals have been consistently observed in meadows north of the existing ski area and evidence of some moose browsing along the powerline and in a swampy area below the daylodge has been noted frequently (G. Harrison, pers. comm.; pers. obs.).

Goats

Although goats are less conspicuous in the study area than the other ungulates and reported sightings are not frequent, the biophysical inventory (Holroyd and Van Tighem, 1983) indicates that the upper slopes and cliff areas of Mount Norquay are characteristically very important habitat. Most of the mountain's east- and south-facing slopes are also important (Figure 17).

Pellets and goat hair observed below the cliffs and in alder/willow thickets on steep slopes above Forty Mile Creek indicate that goats do occur in the area, probably with greater frequency than wildlife observations indicate.

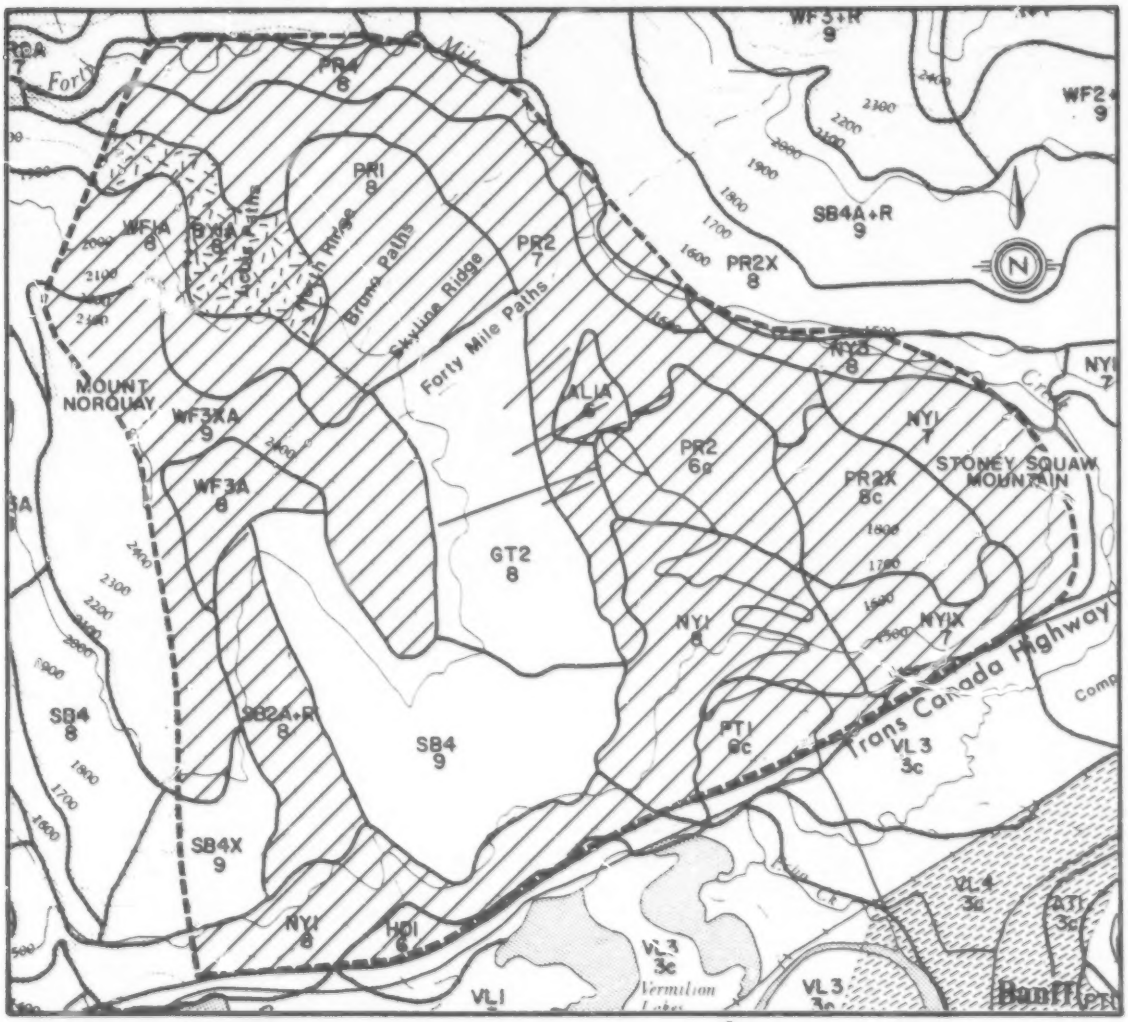
4.6.2 Implications of Development

(a) Invertebrates

Proposed development will have some effect on terrestrial invertebrate populations, primarily by changing microhabitats provided by existing vegetation and soil. These changes are not expected to be significant. Special mitigating measures are necessary to protect aquatic invertebrates, however. Soil erosion and subsequent stream sedimentation in Forty Mile Creek must be minimized to protect benthic fauna. Stream flow must be maintained so that portions of the creek bed which are normally wetted do not become dry. Therefore, to protect aquatic habitat, water withdrawal for snowmaking purposes must be restricted during periods of low flow. (See Section 4.5.2a).

Figure 16: Moose Habitat Potential

(Holroyd and Van Tighem, 1983)

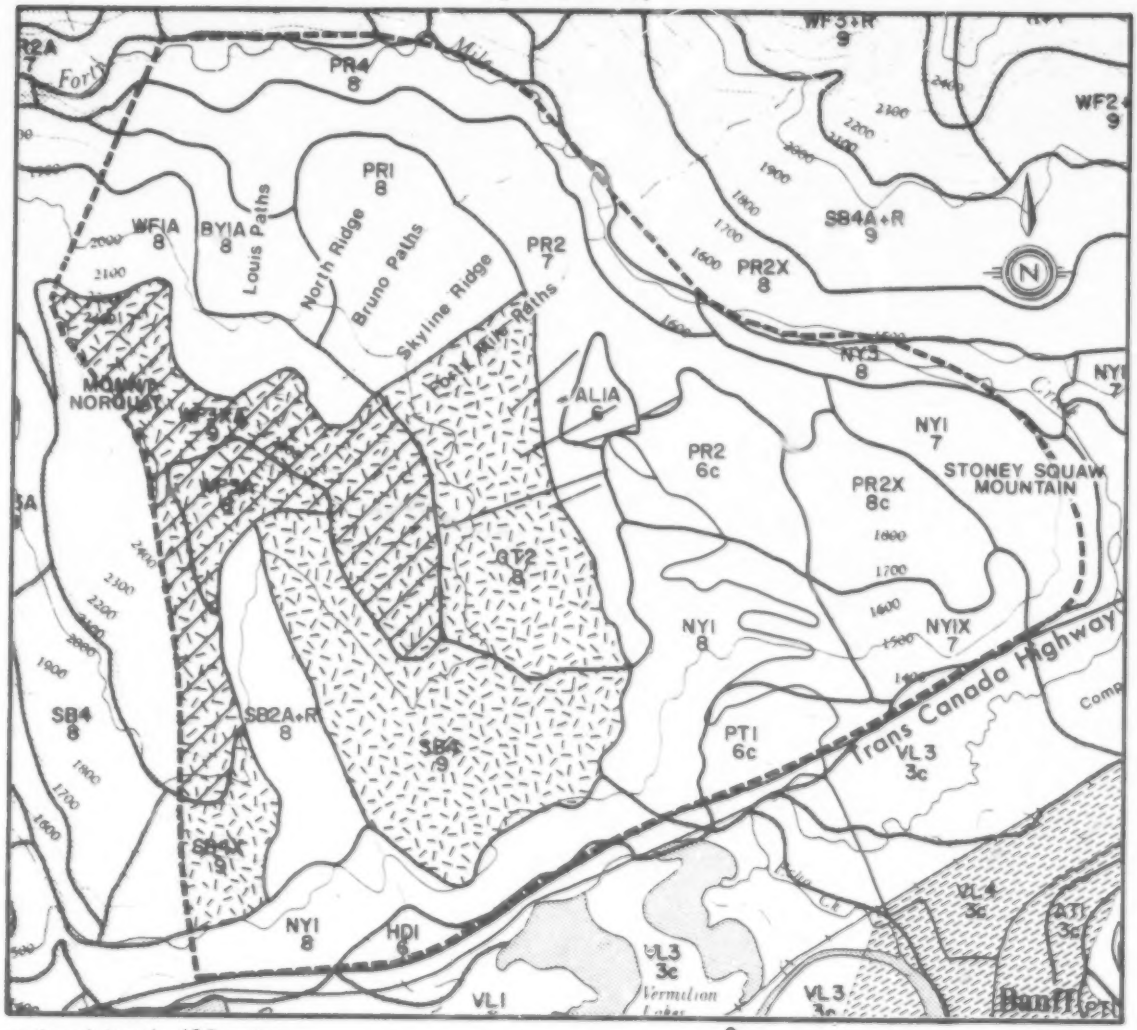


high summer habitat potential

moderate winter and / or summer habitat potential

Figure 17: Goat Habitat Potential

(Holroyd and Van Tighem, 1983)



contour interval – 100 metres
contours are approximate due to metric conversion

high or very high winter habitat potential

high summer habitat potential

(b) **Fish**

Ski area development could have an impact on fish populations inhabiting Forty Mile Creek. During construction and until bared soils are revegetated, soil erosion may increase sediment loads in Forty Mile Creek and result in impacts to benthic fauna (food source for fish), on fish spawning areas and in extreme cases, actual smothering of fish and fish fry. Measures to prevent soil erosion should be employed. Special care must be taken during any in-stream or streambank construction, such as water intake structures for snowmaking, to ensure that excessive turbidity is avoided. Such activities must be scheduled to avoid critical periods such as spawning. A number of factors relating to structures in the stream -- approach velocity, potential for entrainment, disruption of stream flow patterns and creation of barriers -- must be carefully evaluated during intake design to ensure water withdrawal facilities have a minimial effect on fish populations.

Over the long term, water uptake for the snowmaking system may impact fish populations if water levels are reduced below the discharge required to meet instream flow needs. To protect fish populations in Forty Mile Creek, water withdrawal for snowmaking must be restricted during periods of low flow (Bietz et al, 1985; Pearse et al, 1985). (Also see Section 4.5.2a).

(c) **Herptiles**

In general, the study area is poor habitat for herptiles so ski area development is unlikely to have consequential impact on herptiles. Caution should be used in manipulation of Forty Mile Creek, however, as siltation could have deleterious effects on amphibious species which probably exist in the streamside zone.

(d) **Avifauna**

Removal of timber and brush to develop runs and build new lifts will be at the expense of those bird communities which prefer closed timber, but conversely will benefit species attracted to more open vegetation. Water withdrawal from Forty Mile Creek during the winter could adversely affect American dippers, as low water levels may reduce open water and limit benthic fauna populations, a primary food source.

The Douglas fir forest found on the south-facing slopes of Mount Norquay and Stoney Squaw Mountain is restricted in areal extent in Banff National Park. The bird community associated with this vegetation type is, therefore, also restricted in distribution in the park (Holroyd and Van Tighem, 1983). Abandonment of the North American run which affects this special area will benefit this bird community.

(e) **Small Mammals**

As with birds, meadow habitat dwellers will be favored by ski hill development while inhabitants of undisturbed forest will be disadvantaged. Animals which colonize disturbed sites or open meadows - such as deer mice - will inhabit the runs, while populations of jumping mice, Gapper's red-backed voles and red squirrels will decline. The runs will provide poor winter habitat, as snow packing will prevent or destroy the formation of subnival tunnels. Loss of the avalanche shrub community in Bruno avalanche path will disturb hares and porcupines which inhabit this productive habitat. Although the impact and loss of small mammals on this site will be dramatic, in a larger perspective (e.g. park-wide) the impact would not be so significant that further consideration of the development plan is precluded.

(f) **Large Predators**

Conservation of habitat for prey species is a critical element in the protection of large predators. Coyotes are exceptionally adaptable, and so may be little impacted by ski hill expansion. On the other hand, cougar are so uncommon in Banff National Park that "even low levels of unnatural mortality and minor habitat loss may reduce populations below critical levels" (Holroyd and Van Tighem, 1983). Similarly, although loss of the habitat contained in the Bruno avalanche path will reduce prey available to lynx, lynx are very uncommon and are unlikely to be significantly affected.

Mitigating the impact of ski area development to bears, both black and grizzly, requires both habitat protection and prevention of adverse human/bear encounters. Habitat both adjacent to and within the existing ski area is attractive to bears. Carrion and live prey (especially young ungulates), lush streamside and avalanche vegetation, and abundant berry-producing shrubs provide good feeding opportunities.

Any development which reduces these vegetation types or the area's attractiveness to ungulates would have an unfavorable impact on bears. Furthermore, an increase in summer activity (e.g. more maintenance staff on-site and construction work) would increase the potential for aggressive encounters. Alternatively, closure of the summer gondola operation will reduce the number of visitors to the area. Very strict control of garbage and other foodstuffs is imperative to ensure that bears are not attracted to human-related activities.

(g) **Ungulates**

Redevelopment within the existing heavily used area will not significantly increase current impacts to the wildlife populations of Banff National Park. Extension and relocation of existing lifts and additional snowmaking will not significantly increase ambient levels of disturbance to ungulates or their habitats. Construction of a new lodge and rehabilitation of the existing site also would be of limited consequence to wildlife populations in the area, as would disturbance of a local poorly drained area near Parking Lot 3 which currently displays some use by elk, deer and moose.

There is little doubt that the south-facing slopes of Mount Norquay and Stoney Squaw Mountain are some of the most important habitats for ungulates in Banff National Park. The Biophysical Inventory (Holroyd and Van Tighem, 1983), Olson (1984), and Woods (1987a; 1987b) stress the importance of these slopes as resting, feeding, rutting and travel habitat for elk, sheep and mule deer. Woods' observations (1987) confirm that impacts to elk in this area could have widespread effects, as elk collared in the lower Bow River Valley are known to range widely (e.g. Mount Assiniboine Provincial Park, Kootenay National Park).

The south-facing slopes of Mount Norquay and Stoney Squaw Mountain are an important travel corridor for wildlife movement, both up and down the Bow Valley (east/west), and from the Forty Mile Creek drainage into the Bow Valley. Rough topography (Mount Rundle and cliff bands on Stoney Squaw Mountain), visitor facilities (Banff town, outlying commercial accommodation - the Timberline Lodge, Banff Springs Hotel and Rocky Mountain Resorts - and campgrounds), Vermilion Lakes, the Canadian Pacific Railway and the Trans-Canada Highway all serve as impediments to wildlife movement in this narrow part of the Bow Valley. There is little opportunity for wildlife to move east and west in the valley without interference by human facilities. The south-facing slopes of Mount Norquay and Stoney Squaw Mountain is the last remaining barrier-free route available for wildlife movement. Its importance is amplified because of fencing on the Trans-Canada Highway, which prevents cross-valley movements except at underpasses.

Earlier development plans proposed lift construction and development of new ski terrain with snowmaking on the south-facing slope of Mount Norquay. However, partly in recognition of the significance of this area as wildlife habitat, and the importance of ensuring that wildlife has undisturbed access to and through it, Banff Lifts Limited now proposes to retire the North American run.

The gully which runs down to Forty Mile Creek from the bottom of the Wishbone area displays heavy use by ungulates as a travel route, with a number of wildlife trails either running along the gully or traversing it. A water uptake pipe for the snowmaking system is situated here and will probably require upgrading when the snowmaking system is expanded. The pipe is currently on the ground surface, and in places is suspended across rough topography. Because little ongoing activity is associated with the pipe, its presence probably does not have, and is unlikely to have, a significant impact to the wildlife which uses this gully, as long as wildlife can continue to cross it easily.

Avalanche slopes north of the Wishbone (i.e. Forty Mile, Bruno and Louis avalanche paths) provide attractive feeding habitat for elk, mule deer and moose throughout much of the year, including winters of low snowfall. Throughout the forest on Skyline Ridge, wildlife trails, trees debarked by rutting bulls, and beds indicate the heavy ungulate (primarily elk) use which this habitat receives. During the fall, elk bugling, wallowing and rubbing provide evidence that this area is heavily used for rutting. The forest provides excellent cover for elk which feed on adjacent grassy ski runs and the shrubby meadows of avalanche paths. Development of ski terrain on Skyline Ridge will detract from the attractiveness of this area to resting ungulates; however, as this type of habitat is very common and occurs in proximity to the open runs and avalanche slopes, it is likely that animals which currently use it will readily adapt to the new situation. The selective removal of forest cover for new ski runs will increase grazing habitat for elk and so will provide additional open slope foraging opportunities during the spring, summer and fall.

Ski terrain development in the Bruno avalanche path will require removal of the shrubby vegetation which currently provides habitat favoured by elk cow/calf groups. These animals are reluctant to use the open grassy meadows created by ski runs, and so will be displaced by the clearing. To limit this impact on this special age/sex class, removal of shrub habitat should be minimized, and activity in the area limited during the summer to prevent disturbance to animals which may continue to use remaining habitat above and below the developed terrain. This will be a permanent environmental cost associated with creation of ski terrain in the Bruno avalanche gully.

4.7 AIR QUALITY

4.7.1 Existing Conditions

Air quality in the study area is generally good, although smoke from campfires has been and will continue to be a major, but sporadic contributor to air pollution in the Bow Valley. Localized pollution can also be attributed to motor vehicle exhaust and space heating in Banff. During the summer, suspended particulate levels occasionally cause short term air pollution.

4.7.2 Implications of Development

Expansion of the ski hill will be associated with more motor vehicle traffic using the access road and parking lots. An elevated level of carbon monoxide (CO) and other exhaust pollutants will result in localized air quality deterioration, particularly during inversions. This is small, though, when compared to exhausts of motor vehicles on the Trans-Canada Highway located at the bottom of the ski hill.

Construction of facilities and slope recontouring will result in bared soils, and subsequent dust pollution until revegetation is achieved. Slash disposal by burning will result in short term smoke pollution, but is unlikely to have a more significant contribution than campfire smoke.

The use of electrically powered lifts as proposed in Banff Lifts Limited's 1988 development plan will prevent the localized air pollution which could result from fossil-fuel powered lifts on-site.

It is unlikely that the development of additional facilities and runs at the Mount Norquay area will result in significant deterioration of air quality in the Bow Valley.

4.8 AESTHETIC RESOURCES

> People speak enthusiastically of the "park experience", but what, precisely, do they mean? While tastes and definitions vary, the "park experience" is the individual response to the park's essential elements : scenery, clean air, water, the presence of wildlife, and the sheer expanse of landscape. Maintaining those elements, then, is a basic necessity of managing Banff, Jasper, Kootenay, and Yoho national parks and of the entire parks system and requires skilled land use planning (Canadian Parks Service, 1986).

4.8.1 Existing Conditions

Banff National Park is widely renowned for its beautiful scenery. Despite transportation corridors and visitor service facilities, its landscapes remain, for the most part, natural. Scenic beauty is one of the most important and significant natural resources of the park. In fact, designation of the Canadian Rocky Mountain Parks World Heritage Site, of which Banff National Park is an important component, was based largely on the quality of natural scenery found in the area (Canadian Parks Service, 1983).

The Mount Norquay Ski Area is in the most visible location of any ski facility in national parks, within sight of the Trans-Canada Highway, the Canadian Pacific Railway, Banff town, and most other highly visited locations in the lower Bow Valley. Fortunately, the configuration of most of the cleared areas at the Mount Norquay Ski Area resembles adjacent avalanche paths and therefore is less visually obtrusive than runs at other ski areas - Lake Louise, for example. Nevertheless, the straight and curving cuts of the existing ski runs, particularly the North American, are an obvious visual presence on the flank of Mount Norquay.

The introduction of lighted night skiing in 1979 created an entirely new type of visual statement. Night lighting is an unmistakable human intrusion where one would otherwise expect snowy slopes to be illuminated only by moonlight.

Some ski area activities are associated with noise. Snowmaking guns and compressors are noisy. Sound from explosives used for avalanche control is intrusive, and audible for long distances. Approximately 150 explosive charges are currently used at Mount Norquay during an average snow year (K. Everts, pers. comm.).

4.8.2 Implications of Development

Despite the difficulty of measuring or rating visual intrusions in an entirely objective way, the value of scenic integrity of natural landscapes is becoming increasingly recognized in the management of protected areas. In the national park environment, protection of the natural appearance of landscapes is of great importance.

Implementation of the 1988 Mount Norquay Development Plan could have a net positive effect on the ski area's impact on the aesthetic value of the lower Bow Valley. The most significant visual impact of the current ski area is the North American run. The unnatural appearance of this

clearing in the forest is obvious to visitors in the lower Bow Valley and to many, is the only noticeable daytime aesthetic impact of the ski area. Abandonment of this run will allow it to return to a natural appearance.

Lighting to provide for night skiing is a highly visually intrusive activity. Increased illumination for additional night skiing would be an addition to an already significant aesthetic impact. If increased night skiing is to be proposed, an illumination plan will be required to enable an adequate assessment of aesthetic impacts.

The remainder of the existing ski area is not visually obvious to most visitors to Banff because the configuration of the runs is similar to natural avalanche paths. New tree planting to soften the appearance of existing runs will continue to reduce the visual impact.

Clearing will be required to develop ski terrain on Skyline Ridge. If "disguised" as avalanche paths by avoiding straight line and horizontal cuts, it will not be easily noticeable to Bow Valley visitors. In addition, much of the terrain proposed for new development is not visible from the Bow Valley. Tree removal for the new chair(s) required to service the Skyline Ridge must be designed to avoid the appearance of an artificial clearing.

Noise from explosives used for avalanche control is intrusive and is heard throughout the lower Bow Valley. Increased noise will be associated with the development of new ski terrain because more extensive snowmaking and avalanche control will be required. This is not expected to have a noticeable impact to park visitors because of the existing ambient noise of activities in the Bow Valley.

4.9 ARCHAEOLOGICAL RESOURCES

4.9.1 Existing Conditions

Recent archaeological investigations in the Bow Valley have produced discoveries of surprising significance (Steer and Porter, 1981a, 1981b; Steer and Fedje, 1983; Fedje and White, 1984). What was once thought to be an area relatively barren of prehistoric human occupation is now found to have been inhabited by native North Americans for the last 11,000 years. These people exploited a wide range of resources in the area to satisfy their basic subsistence and technological needs.

Important and interesting sites of both prehistoric and historic period origin have been discovered and investigated at the base of the Mount Norquay road where it intersects with the Trans-Canada Highway. Of note is a prehistoric campsite quarry on rock outcrops of Stoney Squaw Mountain near the Trans-Canada Highway. The quarry area extends several hundred metres up the Stoney Squaw slopes.

At this time no significant archaeological resources have been identified within the developed ski area.

4.9.2 Implications of Development

Currently there has not been a comprehensive survey of the study area to determine where significant archaeological or historical resources occur. Consultation with knowledgeable archaeologists is required during more detailed design stages so that archaeological resources may be identified and assessed.

4.10 PEOPLE, RECREATION AND LAND USE

4.10.1 Existing Conditions

The focus of human land use of Mount Norquay has changed since the area was first inhabited. The slopes of Mount Norquay have been used by humans for probably more than 11,000 years. Remains of old camps, butchering areas and quarries indicate that native people found the lower Bow Valley a productive hunting area. More recently, in the latter part of the 19th Century, the area's attractiveness as a transportation corridor was heralded by the construction of the Canadian Pacific Railway. Logging, hunting and mining followed for several decades. On the slopes of Stoney Squaw Mountain evidence of the logging activity of the early 20th Century can still be discovered. Tourism and the gradual redefinition of national parks as places deserving special resource protection gradually pre-empted the resource consumptive activities.

Mount Norquay's value as a downhill skiing area became apparent in the 1920's. It has gradually developed into a downhill ski resort with a comfortable skier capacity of about 1,000-1,100 downhill skiers per day.

Winter activities in the area are not limited to downhill skiing. Heavy cross-country ski use is experienced along the trails to Elk Lake, Cascade Amphitheater, Edith Pass, and

Mystic Pass. Particularly when winter snow conditions are good, this trail is one of the most heavily used in Banff National Park. Currently, these trail users park in one of the ski hill's parking lots and traverse the lower sections of the Wishbone and Stoney Squaw runs to reach the trail on the north side of the ski area.

During the summer this trail system is even more popular. It receives heavy use by day-hikers, backpackers and commercial horse outfitters heading for destinations and routes like Edith Pass, Cory Pass, Forty Mile Creek, Elk Lake, Mystic Lake, the Cascade Valley, Flints Park and Stoney Creek.

One of Banff's four summer sightseeing lifts operates at Mount Norquay. During the summer about 20,000 people ride the Norquay lift (B. Fodor, pers. comm.). (Chairs are replaced by four-passenger gondolas in the summer.) A souvenir shop/ticket booth is operated at the bottom of the hill. Once at the top most visitors wander along a short walkway, possibly have a snack at the Cliffhouse restaurant, and view the panorama of the Bow River Valley, Stoney Squaw Mountain and Forty Mile Creek valley. Few venture further across the slopes, although wildlife trails are numerous in the area and provide interesting hiking routes for the more adventurous. Some people follow a steep trail down the Lone Pine run (beneath the gondola), back to the base area.

Not to be neglected are those who "use" the study area yet never actually visit it. Scenery is one of the most important reasons people visit Banff National Park. The slopes of Mount Norquay are visible to visitors in the Bow River valley, including millions of people who each year travel along the Trans-Canada Highway.* In Cheng's (1978) study of Banff visitors, Mount Norquay was the 12th (out of 27) most recognized site name and the 13th (out of 25) most visited site.

Visitors are also excited by seeing wild animals. For example, in Cheng's (1978) study of visitors to Banff National Park, the Mount Norquay road was visited by 13.9% of 337 respondents. Visitors drive this road to sightsee and watch for wildlife. The Mount Norquay road has become increasingly important to this visitor activity because fencing of the Trans-Canada Highway has reduced the opportunities for visitors to see animals along that highway.

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* From 1979 to 1987, between 4.1 and 4.7 million people per year traveled westbound on the Trans-Canada Highway past the Banff National Park East Gate (Canadian Parks Service, Visitor Services, Western Region).

And finally, there are "users" who benefit from the park's protected resources by viewing pictures of the scenery and wildlife, by benefiting from watershed protection, genetic preservation and maintenance of ecological benchmarks, and by the inspiration of knowing that natural protected areas exist for future generations.

4.10.2 Implications of Development

Upgrading ski area facilities will provide better services and a wider variety of skiing opportunities for downhill skiers. However, development of the Skyline Ridge will create significant conflicts, including serious public safety concerns between cross-country skiers and downhill skiers. The cross-country ski trail, therefore, must be relocated to avoid downhill skiers who will be using the existing trail as a traverse.

This trail is also the summer hiking and equestrian trail. Resource impacts and the effects to summer visitors associated with rerouting summer use of this trail requires further investigation. The variety of uses of the area requires careful consideration and management to avoid conflicts among the diversity of park users. The existing horse corrals will require relocation. It appears, however, that suitable areas for corral reconstruction are situated nearby.

Careful attention must be paid to minimizing visual impacts to those who "use" the study area by enjoying its scenery. All facilities must be designed, sited and constructed to blend with the surroundings. Summer users (hikers, equestrians) will be exposed to ski area development for a longer distance on the trail than they are now, but this is unlikely to be a serious conflict. Wildlife habitats must be protected so that seeing wildlife does not diminish as an activity enjoyed by Park visitors. The importance that these Parks hold in people's minds as sources of contemplation and inspiration can only be maintained if environmental protection remains, and is seen to remain, as a critical element in park use.

4.11 HAZARDOUS NATURAL PHENOMENON AND PUBLIC SAFETY CONCERNS

4.11.1 Existing Conditions

Undoubtedly, more people are injured or killed while travelling to or from the ski area than by encountering a local natural hazard at Mount Norquay. A snow avalanche claimed the life of a long-time Banff resident in 1965 when a slide released just below the Cliffhouse and swept down the Norquay slide path (Calgary Herald, March 1, 1965). In January 1981, one person was killed when he fell and slid out of control down the Lone Pine run. Numerous fractures, sprains, lacerations and other injuries related to skiing occur each season.

(a) Avalanche

Much of Mount Norquay's existing ski terrain is affected by snow avalanches, and major avalanche paths separate ridges on the northern flanks of Mount Norquay (Figure 2). The North American avalanche path (Figure 18) lies at the southern edge of the Mount Norquay Ski Area. The Norquay avalanche path (Figure 19) lies north of the Lone Pine run and can be accessed by skiers using the Cascade chairlift. Forty Mile avalanche path (Figure 20) marks the northern edge of the existing ski area. Bruno and Louis avalanche paths lie on the northern slopes of Mount Norquay and are not currently accessed by downhill skiers. Development of Skyline Ridge will require that skiers traverse Forty Mile path and ski terrain will be developed in the Bruno path (Figure 21).

Avalanche terrain at Mount Norquay is characterized by numerous steep and broken snow accumulation zones. The starting areas for avalanches are rugged and difficult to control. The North American and Norquay paths (Figures 18 and 19) threaten presently used ski runs. These paths have similar characteristics :

Length :	800-1,400 m
Vertical Drop :	400-500 m
Width :	100-200 m
Trigger Slope Angles :	25-70°
Run-out Zone Angle :	10-25°
Aspect :	Mostly easterly with south and north-facing gully sides.

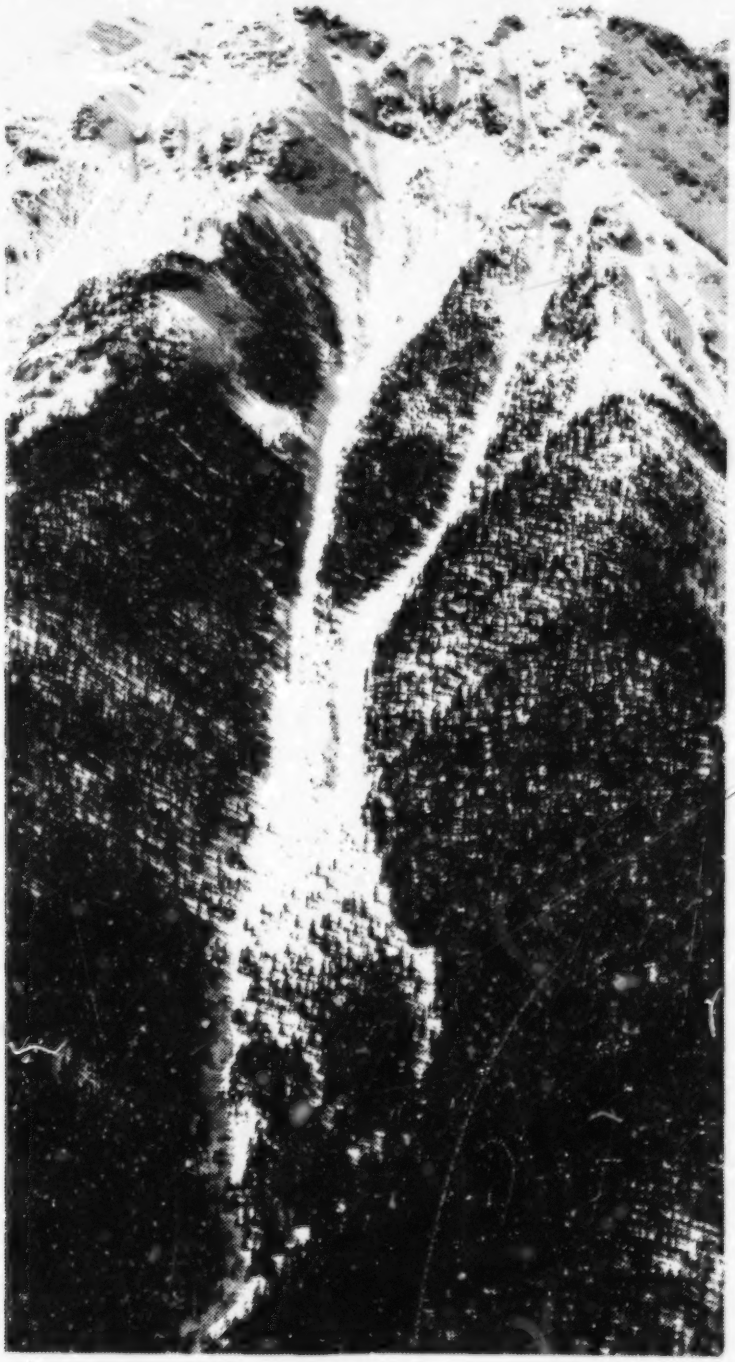
Snowfalls greater than 15-20 cm usually cause avalanches. Mid-day temperatures exceeding +7°C will trigger wet snow slides on south-facing gully sides. Formation of depth hoar on north- and east-facing slopes causes further instabilities that may release with only light snow loading.

Figure 18: North American Slide Path

Figure 19: Mount Norquay Slide Path

Figure 20: Forty Mile Slide Path

Figure 21: Bruno Slide Path



The Warden Service has recorded statistics (Figure 22) on 207 avalanches that ran in the Norquay slide path between 1968 and 1985. All of these avalanches were large enough to completely bury skiers. The Norquay slide path is indicative of other slide areas on the mountain and illustrates the effects of differences in avalanche control efforts and winter snowfall. The high snowfall season of 1971-72, in combination with regular explosive use, yielded 26 avalanches, 19 of which ran past Cunny's Cut ski run. A moderately low snowfall season in 1979-80 (259 cm) and low explosive use (7 charges) caused only 3 avalanches.

In 1984-85, avalanche staff used explosives heavily (119 charges) to closely control the path. This resulted in a relatively high number of avalanches given the low snowfall. However, the increased control distinctly reduced snow accumulations and thus the number of avalanches running below the "Y".

In 10 out of the last 17 years, large avalanches descended the path to below the top of the Lone Pine chair (The Mounds). Sustained snowfalls of over 30 cm cause these large volume and high velocity avalanches. They historically swept across the current Lone Pine chairlift line. In the 1960's, the Canadian Parks Service built an earthfill dike to divert avalanches and protect the lift.

Avalanche forecasting and control is provided by the Canadian Parks Service at cost to Mount Norquay. The current level of control provides safe skiing below the "Y" in the Norquay slide path at least 50% of the season. Control procedures include a combination of explosive and ski stabilization. The broken terrain makes ski access to upper trigger areas impossible, thus reducing the effectiveness and confidence of control efforts (C. White, 1986, pers. comm.).

(b) **Slope Factors**

The existing ski terrain at Mount Norquay is steep and interspersed with cliff bands. Especially under hardpacked and/or icy conditions, skiers falling on upper slopes may find it difficult to prevent uncontrolled sliding. In 1981 a fatality occurred in this manner.

On Skyline Ridge there will be a sharp transition in slope angle between the downhill runs and the traverse which will be used to return skiers to the lift. The mix of slow-moving traversing skiers and fast-moving skiers coming off the run onto the trail at right angles could create a public safety concern.

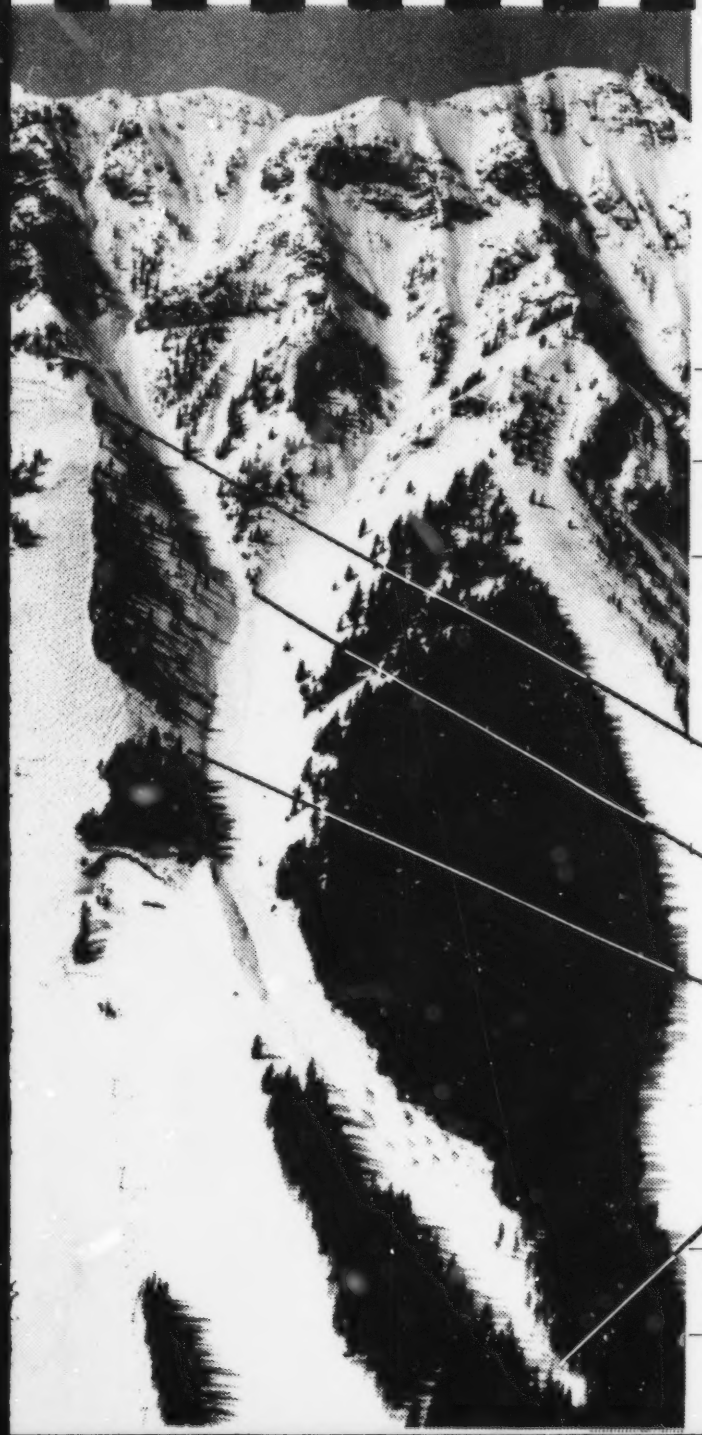


Figure 22: Avalanche Statistics for Norquay Slide Path (1968 – 85)

	WINTER SEASON																	
	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	AVERAGE
TOTAL SNOWFALL (cm)	-	-	378	531	305	330	236	283	168	222	276	259	260	324	209	190	164	
EXPLOSIVE CHARGES UTILIZED	-	-	-	48	16	25	12	2	17	16	6	7	42	10	35	34	119	
OBSERVED NUMBER OF AVALANCHES TERMINATING IN AREA:																		
THE KNOB	3	2	2	0	0	2	2	2	0	6	2	1	7	7	17	4	5	3.65
THE Y	3	3	5	7	2	1	6	0	7	2	2	1	4	10	5	6	0	3.76
CUNNY'S CUT	1	4	8	14	2	4	3	0	4	1	1	1	0	6	1	5	0	3.24
THE MOUNDS	1	0	4	5	2	5	0	0	0	1	0	0	3	1	2	0	2	1.53
THE TREES																		
TOTAL NUMBER OF AVALANCHES	8	9	19	26	6	12	11	2	11	10	5	3	14	24	25	15	7	12.2

(c) **User Conflicts and Public Safety**

Development of ski terrain on Skyline Ridge would require the use of the existing cross-country ski trail as a traverse to return skiers to the lift terminal(s) and base area. This would create a mix of quickly moving downhill skiers encountering slower-moving cross-country skiers moving in both directions on the trail. To avoid the public safety hazard inherent in such a circumstance, the existing cross-country ski trail would have to be relocated to avoid a potentially significant user conflict.

Skyline Ridge is bounded by two avalanche paths. On the south, separating the ridge from the existing ski area, is Forty Mile avalanche path. To the north is the Bruno avalanche path. Both are major avalanche chutes extending from the ridge of Mount Norquay to the valley along Forty Mile Creek. Both have several starting zones which are rugged and difficult to control (Stethem, 1987).

The track of the Forty Mile avalanche path follows a large gully that channels the snow and results in avalanches which tend to run well down the length of the track. Small and medium avalanches tend to run-out in the gully between approximately 2,000 and 1,700 m elevation, with large avalanches advancing lower into the gully than the present hiking trail and onto the knoll below the toe of the gully. Wet or moist flowing avalanches appear to have run even past the toe of the gully and into the ravine which extends down into Forty Mile Creek. Occasionally avalanches have spilled into the coniferous forest along the gully sides and have almost reached the edge of the ski terrain in the existing development. The Forty Mile avalanche site is one of the most active paths in the Mount Norquay group (Stetham, 1987).

The main track of the Bruno avalanche path is centered on a shallow gully which extends from the path's starting zone (2,180 m) down to the top of an open slope at approximately 1,915 m. A less active track lies to the north of the main track and runs into a secondary channel separated from the main channel by a slight ridge. Occasionally, large fast-moving avalanches over-run this ridge. Medium and large avalanches run out between the top of the open slope and the gladed timber at approximately 1,790 m elevation, although occasional larger long running avalanches extend to cross the existing trail at approximately 1,690 m elevation.

(d) **Summer Use Hazards**

With the proposed closure of the summer gondola, summer use at Mount Norquay will decrease. To those people who do continue to visit or work at Mount Norquay, possible threats would come from encounters with wildlife (especially bears, both black and grizzly, which inhabit the area), rockfall (particularly from the cliffs on Mount Norquay), and risk of falls to people who venture onto exposed areas. None of these are more noteworthy at the Mount Norquay Ski Area than at other, similar areas.

(e) **Fire**

The lower Bow Valley has experienced more forest fires than anywhere else in Banff National Park. The Mount Norquay area is of special concern because it is located on steep wooded hillsides above areas where accidental human ignition is probable. Facilities located in this area would be seriously threatened by random ignition fires in the lower Forty Mile Creek watershed and along the slopes of Mount Norquay and Stoney Squaw Mountain above the Trans-Canada Highway (White, 1985).

4.11.2 Implications of Development

(a) **Avalanche**

Proper planning of ski area facilities must include adequate consideration of hazardous natural phenomena - particularly avalanches at Mount Norquay. Avalanche control is an important component of the management of the existing ski area and would have to be expanded to include new terrain to be developed on Skyline Ridge. Stethem (1987) prefaces his report on snow avalanche hazard associated with development of the Skyline Ridge by saying, "The Forty Mile and Bruno avalanche paths are major avalanche sites and they present a significant hazard in developing this area." In developing the Skyline Ridge for skiing, a number of activities will be affected by avalanche hazard: possible chairlift construction over the Forty Mile avalanche path, traverses which cross Forty Mile avalanche path, and development of new terrain on the slopes of Skyline Ridge and in Bruno avalanche gully.

Based on only short-term data, Stethem (1987) makes a rough estimate that a destructive avalanche would reach the elevation of an access lift across the Forty Mile avalanche path once every two to four years. Therefore, over the lifetime of a lift, several avalanches could be expected to affect it. If a lift across Forty Mile avalanche path was designed to withstand potential pressures by protecting towers and removing chairs during periods of hazard, it would be possible to operate a lift which provided skier access across Forty Mile avalanche path.

Every time skiers cross an avalanche path their exposure to unexpected avalanches is increased. A comprehensive avalanche control program would be able to reduce substantially the risk of large avalanches which would provide a hazard to skiers at lower elevations in the Forty Mile path. In contrast, a high elevation traverse would present a significantly greater risk to skiers because of the higher frequency of small and medium avalanches at the higher elevation. Stethem (1987) suggests that any traverse of the avalanche gully be kept as low as possible to reduce skiers' exposure to avalanches reaching the traverse.

The proposed skiing terrain to be developed in the Bruno avalanche path would present some risk to skiers but, with a comprehensive avalanche control program including temporary closure and accurate avalanche forecasting, the ski terrain could be protected to an acceptable degree of risk.

Similarly, skiers on terrain to be developed on meadow areas and glades of the Skyline Ridge could be provided with an acceptable level of protection from snow avalanche (Stethem, 1987). Overall, Stethem predicts that closures would be required on approximately five to ten days during the operating season for avalanche protection. Closures would vary from a few hours to a few days duration, with closures of greater than two days occurring infrequently during extended periods of avalanche hazard.

Recontouring proposed to smooth rough topography could remove the small ridge which currently controls small and medium avalanches which originate in a secondary track on the north of the Bruno avalanche path. Some changes in previous run-out characteristics could therefore result from terrain recontouring in the gully.

(b) **Slope Factors**

Ski runs on some slopes of Skyline Ridge would terminate on the relatively flat bench where the return traverse would be situated. This could be a significant hazard because of the abrupt change from a steep to flat slope angle combined with a right angle turn. It would also create a situation where fast-moving skiers would be mixed with slower-moving skiers traversing on the trail. Ski trail design must ensure that the two streams of skiers can be safely merged to prevent an unacceptable hazard caused by unsafe trail arrangements.

Increased hazards to skiers because of steep terrain are not anticipated, although the relatively icy nature of artificial snow requires special diligence to ensure that snow conditions are maintained so that slopes can be safety skied.

(c) **User Conflicts and Public Safety**

Mixing cross-country skiers and downhill skiers on the same trail would cause an unacceptable situation of conflict between two types of park uses, and create an unacceptably hazardous circumstance because of skier collisions. Therefore, if the ski area traverse is to use the existing cross-country trail, a new separate trail must be developed for cross-country skiers.

(d) **Summer Use Hazards**

Natural hazards at Mount Norquay are not exceptional in Banff National Park and implementation of components of the development proposal would have little effect on the existing situation. Responsible handling of garbage by the summer operators will help prevent bears from becoming a problem. If bears, particularly grizzlies with cubs, become resident in the area, temporary closure to summer visitors could be implemented.

(e) **Fire**

Because of Mount Norquay's location in one of the highest forest fire hazard areas in Banff National Park, methods to accomplish emergency evacuation of summer visitors and staff should be considered. Equipment, trained staff, and quick response plans to extinguish small fires should be maintained by summer operators to ensure that chance ignitions can be extinguished.

4.12 REHABILITATION

4.12.1 Existing Conditions

In September 1979, Banff Cablelifts Limited (now called Banff Lifts Limited) commissioned David Walker and Associates Limited to examine the existing vegetation of the ski area and develop a rehabilitation plan which could improve its skiing and/or aesthetic qualities (Walker, 1979). Walker's report suggests rehabilitation techniques (fertilization, scarification, seed mixes and application) specific to identified problem areas at the hill.

In the fall of 1982, G. Harrison of the Canadian Parks Service conducted an impact inventory of the Mount Norquay Ski Area, and provided a rehabilitation plan (Harrison, 1984). In her report she noted that many of the recommendations in Walker's report had been implemented and

the program would be continued as part of Mount Norquay's summer maintenance schedule. A number of site-specific items remained, but overall, the Mount Norquay Ski Area has had good success with revegetation efforts. Some problems remain outstanding, however, including unstable and eroding cuts behind the upper Cascade chair terminal, old cuts along the lower North American run, and deepening erosion of the trail running down the center of the Lone Pine run.

Since 1986, Banff Lifts Limited has undertaken a tree planting program. Tree islands have been established in open runs, providing a more interesting and aesthetically pleasing experience for ski area visitors (Buckingham, 1988).

4.12.2 Implications of Development

Since 1979, managers of the Mount Norquay Ski Area have been sympathetic to rehabilitation of areas damaged during the original construction of facilities and ski area operation (Buckingham, 1988). Rehabilitation prospects at Mount Norquay are the best of the four national park ski areas.

Harrison (1984) emphasizes the need to integrate rehabilitation into the planning phase of development in order that initial impact is minimized and revegetation potential maximized. Salvage of topsoil is critical. Substantial lead time (two or three years sometimes) is required to ensure that suitable plant material for revegetation is available. Native species are preferable. Despite continuing emphasis on pre-planning before terrain disturbance, the ski jump out-run was reconstructed in 1985 and rehabilitation was not initiated until a year later.

Droughty and infertile conditions on the lower south-facing slopes of Mount Norquay will make unassisted revegetation of the abandoned run relatively slow. Re-establishment of the natural vegetation on this site should be an objective of rehabilitation plans which should be prepared and implemented as a condition for development of Skyline Ridge.

Almost all activities associated with ski area development will create some site disturbance and therefore require rehabilitation. Recontouring of terrain in the Bruno avalanche gully and construction of cat tracks/traverses will require careful rehabilitation.

It is important that prior to any site disturbance a rehabilitation plan is established and a strong commitment made to its timely and successful accomplishment following disturbance. (This is a requirement of the Management Framework, Canadian Parks Service, 1986).)

4.13 REGIONAL CONSIDERATIONS

4.13.1 Existing Conditions

As discussed in Section 4.10, "People, Recreation and Land Use", the implications of expansion of the Mount Norquay Ski Area reach beyond the physical boundaries of the area itself. Similarly, the ski area is affected by external factors.

Vigorous competition for the skier market by other ski areas, including Nakiska, Fortress Mountain and Panorama outside national parks, has a major influence on Mount Norquay's economic viability. Currently, Mount Norquay serves a limited number of skiers and provides a relatively special type of skiing experience. Mount Norquay's future role in the milieu of opportunities for the skiing public is unknown at this time. Economic conditions and the amount of disposable income enjoyed by the ski area's potential clientele also have an impact on market strength.

Mount Norquay's current clientele is primarily local residents who require minimal additional services in the Banff area. Mount Norquay is locally perceived as a good beginner training area and is used by many school programs for that purpose. Ski area staff is housed primarily in accommodation provided by Banff Lifts Limited in the town of Banff.

4.13.2 Implications of Development

Redevelopment of the Mount Norquay Ski Area as proposed would increase the number of skiers and require a comparably greater number of staff. The ripple effect of this development may lead to pressure to provide additional visitor accommodation and services. Banff Lifts Limited reports that sufficient staff accommodation is available for projected staff increases, although it would require displacement of some employees from other businesses who currently occupy Banff Lifts Limited's housing. The public service sector - garbage handling, water and sewage treatment, avalanche control staff - would similarly face greater demands.

As planning for expansion of the ski area proceeds, the socio-economic effects of the development to the surrounding communities must be addressed. Opportunities for expansion of staff and visitor accommodation and services in Banff are limited. Therefore, any further consideration of expansion of the Mount Norquay Ski Area must consider the

direct and indirect effects to Banff and Canmore. If expansion of the ski area is to occur, it must be demonstrated that the greater staff and visitor demands, and the associated "multiplier effect" of indirect and induced revenues and employment, can occur harmoniously with the limitations and other demands of those communities.

The economic viability of the expansion proposed in the development plan has important environmental implications. While investment risks are wholly the responsibility of the proponent, it would be a most unfortunate circumstance if the ski area redevelopment disturbed previously unimpacted terrain only to have the area not used because economic conditions did not make it profitable to do so.

PART 5

PUBLIC CONSULTATION

The Canadian Parks Service solicits public opinion on plans, policies and major land use commitments in the management of National Park lands.

A draft of this document, "Initial Environmental Evaluation of the 1988 Mount Norquay Ski Area Development Plan", was completed in October 1988, and made available for public review. Concurrently, copies were provided to the Regional Screening and Coordinating Committee (RSCC), a peer review group consisting of scientists from a number of services of Environment Canada. Based on comments provided by the public and the RSCC, the draft IEE was revised to complete this final report.

In November, 1988, open houses were held in Banff, Calgary and Edmonton to provide information and receive public comments about the Mount Norquay Ski Area 1988 development plan. Approximately 720 information packages were mailed out or provided to meeting participants. One hundred forty nine people attended the meetings, where representatives of Banff Lifts Limited (the proponent) and the Canadian Parks Service were available to discuss the plan. Ninety response forms, letters or briefs commenting on the proposed development were received by the Canadian Parks Service.

A summary of public input was prepared, and mailed to everyone on the mailing list for the Mount Norquay planning program (909 addresses).

A wide variety of opinions were expressed by respondents. Those who supported the proposal felt it would improve the ski area operation and would not cause excessive damage. Those who were not in agreement with the proposal focussed largely on the need to protect park resources and halt incremental development. They especially expressed concern about terrain modification and water withdrawal for snowmaking (Canadian Parks Service 1989a).

PART 6

KNOWLEDGE DEFICIENCIES

Banff Lifts Limited is committed to the concept of refocusing the ski area use northward by retiring the North American run and developing ski terrain on Skyline Ridge. Details of the implementation of that concept have not been finalized. Therefore, it has not been possible to provide a final determination of the severity and acceptability of the environmental impact of possible development options. Nevertheless, examination of the Mount Norquay area and review of previous development proposals indicates that the concept of Skyline Ridge development by Banff Lifts Limited is environmentally acceptable. (In contrast, development of ski terrain on Stoney Squaw Mountain and ski terrain upgrading on the south-facing slopes of Mount Norquay were conceptually unacceptable because of the obvious severe environmental impacts which would have resulted.)

Further information about the development and about some of the natural resources to be affected is required to adequately assess the site-specific acceptability for implementation of the development concept.

1. Plan Information Required

Further information about the proposed development is required, including :

- detailed lift and run alignments proposed for Skyline Ridge;
- specific requirements for terrain recontouring for skier traverses, ski terrain preparation, facility construction and maintenance, and operational requirements;
- detailed plans showing all vegetation disturbance;
- reclamation plans;
- a comprehensive water and waste water (including run-off) management plan;
- comprehensive consideration of the "balance" of the ski area design, demonstrating a consistency between uphill lift capacity, ski terrain availability and ski area services (e.g. staff accommodation, upgraded visitor services, parking);

- operational requirements (e.g. access for maintenance);

- avalanche control requirements, including an analysis of effects that avalanche hazard will have on ski area operation, and viability of development of Skyline Ridge;

- details of lodge and maintenance building including abandonment of old structures;

- relocation, extension and changes to existing runs and lifts;

- details of any new facilities to be developed in the existing area;

- rehabilitation plans for the North American run; and

- specific plans for the relocation of Forty Mile Creek cross-country ski trail, summer hiking/equestrian trail, horse corrals, and redirection of current users.

2. Environmental Information Required

Site specific studies pertinent to environmental protection performance requirements for construction and operation must be identified before plan implementation. Performance standards, mitigation measures, operating procedures and environmentally sympathetic design and construction methods are examples of criteria which must be established before any ski area redevelopment or expansion can be undertaken. Special review of sites to be disturbed must include an inventory and assessment of significant vegetation species or associations, special geological features, and cultural resources. This procedure is well established, being a normal part of any development proposal review which includes environmental assessment.

Prior to development of new and upgraded lifts and ski terrain dependent on an expanded snowmaking system, further assessment of the operation of the snowmaking system and possible limitations to water withdrawal is required. This assessment must include further investigation of actual winter flows in Forty Mile Creek, fish and related habitat requirements in Forty Mile Creek, the development of operational techniques to measure daily flows under winter conditions, and a commitment to limit water withdrawal when specified minimum flow levels are reached.

PART 7
CONCLUSIONS AND RECOMMENDATIONS

The "Plan for the Improvement and Expansion of Mount Norquay Ski Area" (Banff Lifts Limited, 1988) is the proponent's proposal for future long-term development of the Mount Norquay Ski Area. This Initial Environmental Evaluation has been prepared by the Canadian Parks Service on the basis of investigations of the Mount Norquay area and an assessment of potential environmental impacts which could be expected.

7.1 Summary

Based on reviews of a series of development plans prepared by Banff Lifts Limited, it has been determined that the concept of developing ski terrain on Skyline Ridge is environmentally acceptable. The most significant potential environmental impacts associated with expansion to this area appear to be from terrain recontouring, vegetation removal (which relates to impact to special elk and deer habitat), and water withdrawal for snowmaking.

It appears that relocation of the daylodge and other buildings, and revisions to lift alignments and runs within the existing ski area could be accomplished without unacceptable environmental impacts.

Abandonment of the North American run, and removal of the south-facing slopes from consideration for further ski area development is an important component of the environmental protection aspects of the plan. The protection of the very important wildlife habitat on these slopes will compensate for the wildlife habitat which will be lost when the Bruno avalanche gully is developed as ski terrain.

Previous consideration of further development on Stoney Squaw Mountain resulted in the decision not to include it in the current development plan. Ski terrain preparation on Stoney Squaw would have resulted in severe environmental disturbance, and the slope characteristics would have provided only marginal quality ski runs.

The evaluation of environmental impacts presented in this IEE has been based on a conceptual plan for ski area development provided by Banff Lifts Limited and therefore, has not addressed site specific issues.

7.2 CONCLUSIONS

The long range plan is not sufficiently detailed to allow for unconditional approval of ski area development. Sufficient information is available, however, to know that careful implementation of the general concepts presented by Banff Lifts Limited is likely to be environmentally acceptable, although some elements of the proposal -- a high elevation traverse from the Skyline Ridge, for example -- may not be.

Prior to any implementation of the development plan, significantly greater detail must be provided. Detailed plan proposals must be investigated for environmental and socio-economic impacts, and assessed to ensure that ski area planning provides for an acceptable balance of facilities, terrain and skier opportunity. Implementation of the plan must be conditional on clear commitments by the proponent to detailed environmental protection requirements.

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